Prepared For:
USAID-SARI/Energy Program
www.sari-energy.org

Review of Appliance Testing Capabilities in South Asia

Nexant

November 2003

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for

United States Agency for International Development

Under

South Asia Regional Initiative for Energy

Prepared by

Nexant SARI/Energy

Acknowledgements

Nexant would like to thank all those who provided input to this report, including members of the following organizations:

National Accreditation Board for Testing and Calibration Laboratories
Bureau of Indian Standards
Electronics Regional Test Laboratory (North)
Regional Testing Centre (NR)
Electrical Research and Development Association
Consumer Education and Research Centre
Central Power Research Institute
Indian Institute of Technology
Voluntary Organization in Interest of Consumer Education (VOICE)
International Institute for Energy Conservation, IIEC
Bureau of Energy Efficiency, India
Power Division, Ministry of Energy and Mineral Resources – Bangladesh
Bangladesh Standards and Testing Institution
Bangladesh University of Engineering and Technology
Nepal Bureau of Standards and Metrology
National Engineering Research and Development
National Engineering Research & Development Centre of Sri Lanka (NERD)
Sri Lanka Standards Institution (SLSI)
Ceylon Electricity Board, Demand Side Management Branch
University of Moratuwa

List of Acronyms

ADB	Asian Development Bank
APLAC	Asia Pacific Laboratory Accreditation Cooperation
BIS	Bureau of Indian Standards
BLF	ballast lumen factor
BUET	Bangladesh University of Engineering and Technology
BEE	Bureau of Energy Efficiency
BSTI	Bangladesh Standards and Testing Institution
CENELEC	European Committee for Electrotechnical Standardization
CPRI	Central Power Research Institute
CERC	Consumer Education and Research Centre
CFL	compact fluorescent lights
CLASP	Collaborative Labeling and Appliance Standards Program
CEB	Ceylon Electricity Board
CSA	Canadian Standards Association
EA	European Accreditation
ERDA	Electrical Research and Development Association
ERTL(N)	Electronics Regional Test Laboratory (North)
ETDC	Electronic Testing & Development Centre, Bangalore
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
ILAC	International Laboratory Accreditation Cooperation
IIEC	International Institute for Energy Conservation
IS	Indian Standards
ISO	International Standards Organization
JEC	Japan Industrial Standards
MRA	mutual recognition agreement
MOU	memorandum of understanding
NABL	National Accreditation Board for Testing and Calibration Laboratories
NEMA	National Electrical Manufacturers Association
NBSM	Nepal Bureau of Standards and Metrology
NERD	National Engineering Research and Development Centre of Sri Lanka
NPL	National Physical Laboratory
RTC	Regional Testing Centre
SARI/E	South Asia Regional Initiative on Energy
SLSI	Sri Lanka Standards Institution
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
VOICE	Voluntary Organization in Interest of Consumer Education
WB	World Bank

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Executive Summary

Introduction

The goal of the SARI/Energy Standards and Labeling Program is the harmonization of test procedures, standards, and labeling for energy consuming products in the Indian sub-continent. To accomplish the harmonization of standards and labeling for products delivered to consumers, test procedures must first be harmonized. In addition, to further facilitate trade and avoid duplicative efforts in testing, testing performed in one country should be accepted in another country. Confidence in test results among different laboratories and different countries can be established by requiring that they be accredited to perform a common test procedure.

Report Objectives

Independent testing laboratories were visited in India, Sri Lanka, Bangladesh, and Nepal, to assess their testing capabilities and suitability for participation in a regional standards and labeling program. In addition, the need and opportunities for laboratories to become accredited were discussed. Of particular interest are test facilities for refrigerators, lamps/lighting, fans, and motors.

Testing Capability

Due to the current activities in SARI/Energy countries regarding test procedures and test facilities, the testing capabilities in each country may change in the near future. As test procedures have not been finalized, this assessment will vary somewhat on the exact test procedure used. Laboratory testing capability for the key products is summarized in Table 1 given below:

Table 1: Test Laboratory Efficiency Test Capability by Product

Product	India	Sri Lanka	Bangladesh	Nepal
Refrigerators	Improvement needed or planned	No (facility under construction)	No	No
Fans	Yes	No	Yes	No
Lighting	Some	Some	Some(marginal)	No
Electric Motors	Yes	No	Some	No

Note: "Some" means it can do some tests.

Table 2 below summarizes the current capabilities for testing refrigerators, fans, lighting, and motors for individual laboratories.

Table 2: Test Laboratory Efficiency Test Capability by Laboratory [1-4]

Country	Laboratory[1]	Refrig-erators	Fans [6]	Lighting [5]	Motors
India	BIS	N	Y	S	Y
	ERTL(N)(2)	P	N	S	N
	RTC	N	Y	S	S
	ERDA	P	N&W	Y	Y
	CERC	NI	Y	Y	Y
	CPRI	NI	Y	Y	Y
	IIT (Delhi)	NI	N	N	N
Sri Lanka	NERD	N	N	Y	N
	SLSI	N	N	S	N
	CEB	P&F	N	N	N
	University of Moratuwa[3]	N	N	N	N
Bangladesh	BSTI	N	Y	S	S
	BUET	N	N	N	Y
Nepal	NBSM	N	N	N	N

(1) See List of Acronyms
(2) Laboratories in Bold are being considered for challenge testing laboratories in India.
(3) Premises not visited – only meeting with personnel.
(4) N = none, Y = yes, S = some capability, P = being planned, P&F = planned & funded, NI = needs improvement, N&W = don't have but would like.
(5) Ballasts, CFLs, tube fluorescent lamps.
(6) Ceiling, pedestal or table (at minimum ceiling fans).

Accreditation

For an independent laboratory to participate in India's Bureau of Energy Efficiency's Standards and Labeling program, it is required to be accredited by the National

Accreditation Board for Testing and Calibration Laboratories (NABL). Several independent and manufacturer laboratories are currently seeking NABL accreditation to test refrigerators, which is the priority product for labeling in India. However, in early July 2003, NABL had yet to enroll any refrigerator test assessors and the test protocol was also still in draft form. Nevertheless, the inter-laboratory comparison test (part of proficiency testing) was scheduled to begin in October, 2003. At the time of the testing laboratory tour in early July, the primary laboratory for the inter-laboratory comparison had not yet tested a refrigerator.

Sri Lanka does not have a national independent accreditation body, but it has been in the process of establishing one for the last three years. The Sri Lanka Standards Institute has an accreditation agency, but it is not a member of any larger regional or international accreditation organization.

Bangladesh does not have a national independent accreditation body, but a bill has been submitted and an accreditation body could be established before the end of the current year.

Nepal has a department that provides accreditation services and is part of their national standards laboratory. It does not have any affiliation with any other regional or international accreditation organization.

In all cases, accreditation and certification procedures and activities are based on the International Standards Organization's guides and standards.

Summary of Recommendations

Refrigerators

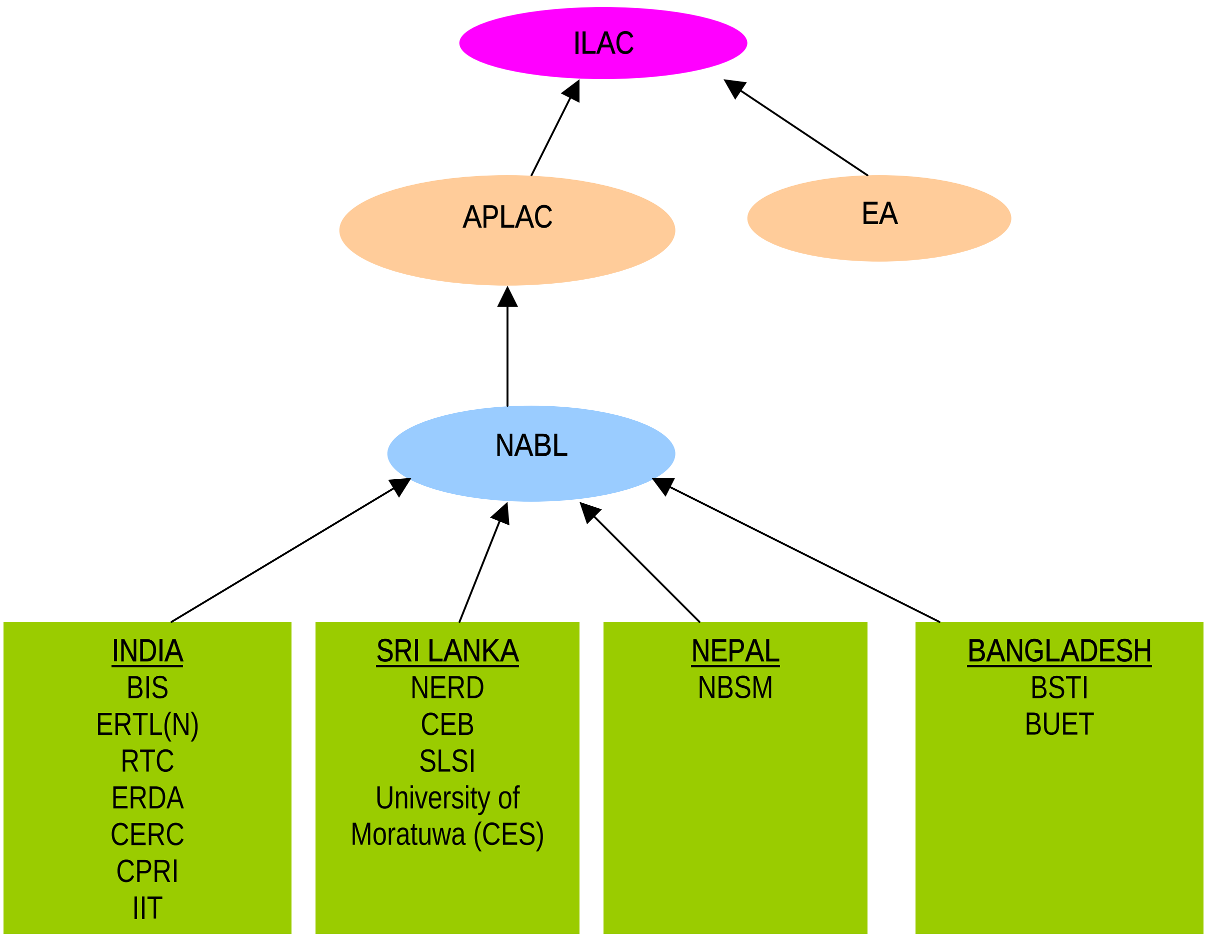
Careful attention needs to be given to all specifications in the test procedure. All laboratories need some modification. There is hesitancy on the part of laboratories to spend money on building or improving laboratories, if the fees from testing need to cover the capital investment. Some laboratories would undoubtedly benefit from training programs. Further more, some guarantee of future work would be a motivating factor.

- India – needs to determine a financially feasible way to continue testing appliances
- Sri Lanka – needs a fan testing laboratory
- Bangladesh – equipment needs to be modernized
- Nepal – has no funds for instrumentation

Accreditation

Accreditation of laboratories should be pursued, and funded, if possible. This report recommends that, until such time that a country has its own internationally recognized accreditation body, it can have its laboratories accredited by India's National Accreditation Board for Testing and Calibration Laboratories (NABL), which is a signatory to the larger umbrella organizations for the accrediting bodies of the

International Laboratory Accreditation Cooperation (ILAC) and Asia Pacific Laboratory Accreditation Cooperation (APLAC). Round-robin tests and proficiency testing should be funded so that there is a consistency in testing among laboratories in the SARI/Energy region. Any differences in test results should be investigated. Figure 1 provides a schematic view of the proposed test facility accreditation process for the SARI/Energy countries.



*See Acronyms List for full titles of laboratories and institutions.

Figure 1: Proposed Test Facility Accreditation Process for SARI/Energy Countries*

Sources of possible funding:
Technical assistance for accreditation: ILAC technical committees
Accreditation assistance: UNIDO/USAID/UNDP
Establishment of test facilities: WB/ADB/JBIC/International Copper association

Section 1 Introduction

1.1 Background

This report is divided into two basic topics: testing faculties and accreditation. For clarity, most of the report is outlined by country and then by test laboratory or organization.

An assessment of the laboratories was intended to identify the general status and capabilities, as well as any improvements necessary to participate in standards and labeling activities. However, this assessment does not in any way negate the need for, or replace, a formal accreditation program, including assessment of general laboratory management (e.g., ISO 17025) and determination of competency to perform tests with specific test protocols. This would also include proficiency testing and inter-laboratory comparison testing (round-robin testing).

Another goal was to gauge any possible sharing of facilities and to gauge the necessity of agreements between countries or laboratories. In addition to asking questions, the visitors to the laboratories explained how laboratories could participate in the standards and labeling process.

1.2 Objectives and Tasks

This paper is the result of visits to testing facilities, associated accreditation bodies, and government ministries that are involved with, or use, the services of testing facilities. These include accreditation bodies, test procedure standard setting organizations, and government standards and labels setting bodies.

Objectives of this project were to:

- Profile existing test facilities and identify opportunities for strengthening of existing facilities
- Identify the need for new facilities
- Review existing regional accreditation procedures
- Recommend ways to strengthen/improve and harmonize existing accreditation procedures; and
- Identify potential areas for further SARI/Energy support

The tasks to achieve this objective are:

- Identify end-use appliance test facilities in the region and prepare an inventory of the basic infrastructure
- Categorize existing capabilities of these facilities for energy efficiency testing for standard setting and labeling of end-use appliances identified under the SARI/Energy Program (refrigerators, lamps, fans, and motors)
- Identify technical, financial, institutional, and training requirements to strengthen existing facilities to meet requirements for energy efficiency testing

- Identify new facility requirements to support standards and labeling initiatives
- Propose ways to share existing or proposed resources
- Review present accreditation procedures adopted by India, Sri Lanka, Nepal, and Bangladesh
- Recommend ways to improve and harmonize accreditation procedures and, if necessary, to support regional standards and labeling programs
- Identify opportunities for further SARI/Energy support; and
- Participate in SARI/Energy training sessions

The first step in the project was to decide which laboratories and institutions to visit and to identify the appropriate personnel to meet with at each location. Based on previous contacts, and a consultant in India, laboratories and agencies were selected and letters were sent requesting a meeting. For Nepal, Bangladesh, and Sri Lanka, Nexant country representatives set up meetings and laboratory visits. A number of people were interviewed and the contact information is given in Appendix B.

2.1 Testing Requirements

The test facility requirements covered in this report include: refrigerators, fans, lighting, and motors. Testing facilities in India, Sri Lanka, Bangladesh, and Nepal were visited. Although there is not complete uniformity regarding the test procedures used to test these products, in most cases, the national test procedure standards are based on international standards and modified to suit each individual country.

The testing requirements for each of the products of interest are summarized in the flowing sections.

2.2 Refrigerators and Refrigerator/Freezers

2.2.1 Refrigerator/Freezer Efficiency Testing Background

Currently, an effort is being made to harmonize the Indian and Sri Lankan refrigerator test procedures. India and Sri Lanka both have test procedures that are based on the International Standards Organization (ISO) test procedures but to which substantial changes were made, including the elimination of test packages, different freezer (evaporator) compartment temperatures, and for India, the method of determining refrigerator volume. Currently, India is planning on using parts of the Australian test procedure as well, especially for testing frost-free refrigerators. Readers should keep in mind that the refrigerator test procedure for the SARI/Energy countries is fluid and may change before this report becomes widely available. Bangladesh has recently adopted an ISO refrigerator test procedure standard.

Although there are differences in the details of individual country test procedures for refrigerators at this point, refrigerator test facilities have some basic requirements in common that would require the same basic test laboratory setup. These are outlined in Table 2.1 below.

Table 2.1 Applicable Refrigerator Test Procedures

	Test Procedure	**Comment**
ISO	7371 (refrigerators without freezers) 8187 (refrigerator / freezers) 8561 (forced air / frost free units)	
India (BEE)	BEE draft	Based on ISO & Australian Std. AS/NZS 4474.1
Sri Lanka	SLS 1230: 2003	Being harmonized with India (BEE)
Bangladesh	BDS-ISO 7371	Adopted the ISO 7371

2.2.2 Testing Requirements

It is important to remember that having the equipment and instrumentation for testing alone is not sufficient. It is also important to have the proper training and to meet all of the requirements specified in the test procedure. These include items, such as, not having excessive airflow near the refrigerators and thermal radiation impacting the refrigerators.

Table 2.2 lists facilities and instrumentation that are requirements regardless of the test procedure chosen, and it also lists requirements that may be required in some test procedures. Test facilities should be designed to not only meet the requirements of the energy efficiency test, but also other tests that may be pre-requisites for an energy label.

Values shown are for the energy efficiency test. Conditions differ for other types of performance tests.

Table 2.2 Refrigerator Facility Equipment, and Instrumentation Requirements

Item	Item Requirement	Accuracy
Uniformly temperature controlled room	ISO 25±0.5°C AS/NZS 32±0.5°C	
Humidity control	ISO **45%** to **75%** BEE **60±5%**	
Air flow measurement device	To ensure air speed limits around the refrigerator do not exceed 0.25 m/s (ISO)	
Temperature measurement device	Recording type instruments (BEE)	Overall uncertainty 0.5°C
Humidity measurement device		IS says ± 0.5°C for temp. sensors in the psychrometer
Power measurement	Watt-hr	± **1%** to nearest 10Wh
Measurement devices to measure the volume of the refrigerator	Length	±0.50 mm
Constant voltage supply	BEE & ISO 8561 Voltage: 230	±**1%**V
Constant frequency supply	BEE Voltage: 50Hz	±**1%**
Time	BEE	±**0.1%**

Some countries require an ice-making test, as well as a condensation test. Other considerations that can affect the energy usage due to surrounding conditions include: how the temperature measurement sensors can be placed inside the refrigerator; ensuring the wall temperatures or lighting in the room are not a large source of heat load on the refrigerator by radiation (i.e., the wall temperatures should be close to the room temperature); and the number of refrigerators that can be tested in one room (proximity of refrigerators to each other).

Because of the 24-hour plus duration of a typical refrigerator test, and the additional hours at constant temperature required to achieve steady state conditions before the start of the test, it is highly desirable to have the test room automatically controlled for heating, cooling, or humidity.

Some differences exist on how to measure the refrigerator volume. There are also requirements for the platform the refrigerator must be set on and the distances from the walls. In addition, there should not be any significant radiation source impinging on the refrigerator under test. For ISO tests, a load pack must be used, but this requirement has been removed from the Indian and Sri Lankan test procedures. ITS has reported in the past an estimated cost of US$ 350,000 for a turn-key refrigerator test facility capable of testing four refrigerators at a time. [1]

2.3 Fans

The primary concern in this report is to determine the requirements for performing energy efficiency tests on various products. It may also be desirable from a work efficiency point of view to perform safety and other performance tests at the same facility and at the same time. Testing time may vary for the air delivery test.

2.3.1 Fan Efficiency Testing Background

There are several methods to test ceiling fans. In the SARI/Energy countries, they all appear to be based on the International Electotechnical Commission (IEC) test procedure, on which the Indian and draft Sri Lankan test procedures are based. The Canadian Standards Association (CSA) test procedure also is in line with IEC. However, one difference is that the CSA test procedure specifies an omni-directional hot-wire anemometer for measuring airflow, whereas, the Indian and IEC test procedures specify a rotating vane-type anemometer. Acceptable fan test procedures are summarized in Table 2.3.

Table 2.3 Applicable Fan Test Procedures

Standards Ins.	Standard	Appliance
IEC	IEC 60879 (1986-10)	Performance and construction of electric circulating fans and regulators
India	IS: 374 – 1979[2]	Specification for electric ceiling type fans and regulators
Sri Lanka	SLS 814: 1988[2]	Electric fans and regulators
Canada	CSA C814-96 - 1998	Energy performance of ceiling fans

Other test procedures for ceiling fans, such as the AMCA or US EPA Energy Star test procedures are substantially different from those listed in Table 2.3.

[1] *Feasibility of an Appliance Energy Testing and Labeling Program for Sri Lanka*

[2] *Under review*

2.3.2 Testing Requirements

Efficiency (also called service value) is defined as the cubic meter of airflow per minute per Watt. The basic procedure is as follows:

> "Readings shall be taken along each of the four semi-diagonals of the test chamber commencing at a point 40 mm from the vertical axis of the fan motor by increments of 80 mm so that each reading represents an air velocity at the man radius of an annulus 80 mm wide. The readings shall be continued until the actual velocity falls below 9.0 m per minute. Each reading shall consist of the time taken by an air movement of 300 m measured by the anemometer, except when such air movement takes more than two minutes, in that case the reading shall consist of the time taken by a movement of some convenient and readable quantity of air requiring approximately two minutes." (IS: 374)

In addition to the time needed to measure the airflow, a two-hour run-in time is needed. For the actual airflow delivery test, about two minutes per point is required.

Fans are tested at maximum airflow. This is an important parameter, because the efficiency at less than maximum airflow is highly dependent on the type of regulator used to control the fan speed. Electronic speed regulators are much more efficient then the resistor-type speed regulator. While the fan is setup for the airflow delivery test, it may be desirable to conduct safety and other performance tests as well.

Analog power measurement instrumentation is adequate when pure sine waves are being measured. However, more and more equipment is becoming controlled by electronic controllers that produce current and voltage waves other than a sine wave. For this condition, a true-power digital Watt or Watt-hour meter is required. As stated in the IEC 60879 test procedure, the term "fan" includes its associated regulator.

Table 2.4 summarizes the air delivery test for ceiling fans.

Table 2.4: Ceiling Fans — Air Delivery Test

Item	Requirement
Test chamber based on IEC 879-1986 (1)	Inner enclosure: 4.5m length x 4.5 m width x 3m height Outer enclosure: 1 to 1.25m space surrounding the inner wall The top of the inner enclosure is covered except for an opening for the fan being tested. A minimum of 1 meter of space is required between the fan and the ceiling. (not less than 4m from ground level).
Anemometer (2)	Rotating vane anemometer having an internal diameter not exceeding 100mm
Apparatus used to position the anemometer	
Volts, Amps, Watts	Class index 0.5 of IEC Publication 51 (5)
Frequency measurement	
Voltage stabilizer	May be required if the test frequency cannot otherwise be kept to a tolerance of ±**1%**
Frequency stabilizer (if needed) (3)	May be required in countries where the frequency is not stable
Temperature, relative humidity, barometric pressure	Not always used but recommended for record keeping
Additional Measurements Recommended	
RPM	Tachometer
Power Factor	PF meter

(1) See IEC, IS, or SLSI test procedure for ceiling fans.
(2) CSA specifies an omni-directional hot-wire anemometer; other standards require a vane type anemometer. The airflow measurement device needs to be accurate down to the lowest airflow that needs to be recorded (9.0 m/min.).
(3) Typically needed in India if power is taken from the mains (utilities).
(4) From IS: 374-1979 but similar to IEC test procedure.
(5) IEC 51 – Direct Acting Indicating Analogue electric measuring instruments and their accessories.

Table 2.5: Ceiling Fans – Accuracy of Measurement

Item	IEC	IS: 374-1979	Sri Lanka	CSA
Temperature		±0.5°C (temp. rise test)		±0.5°C
Voltage, ampere, power factor, Watt	Class 0.5 as defined by IEC 51	Ammeters, voltmeters, and Watt meters shall not exceed **0.5%** of full scale value for instruments used for type tests. For routine and acceptance tests, industrial class instruments may be used (see IS:1248-1968 – specifications for direct acting electrical indicating instruments)	Class 0.5 as defined by IEC 51	**±0.5%**
Interval measured for time measurements				**±0.1%**
Air flow measurements	Rotating vane anemometer with internal diameter not exceeding 100mm	(Same as IEC) It is recommended that the anemometer be calibrated frequently.	Rotating vane anemometer with internal diameter not exceeding 100mm	**±2%** Hot-wire anemometer
Corrections			None for RH or pressure	

As Table 2.6 shows, there are some small differences in the temperature requirements between the various test procedures. Repeatability and reproductability among laboratories of this test procedure should be investigated.

Table 2.6: Ceiling Fans – Air Delivery Test Specifications

Item	IEC	IS: 374-1979	Sri Lanka	CSA
Temperature	20±5°C	Record	20±10°C	20±5°C
Voltage		**±1%**	**±1%**	**±1%**
Humidity		Record		Not controlled
Pressure		Record		
Correction required?		No correction on temp., press. and humidity until an agreement is available on correction factor		
PF		PF should not be less than 0.9 at the highest speed of the regulator		

2.3.3 Pedestal and Table Fans

While the test room layout is different, the basic instrumentation is the same for pedestal and table top fans.

Table 2.7: Cost Estimates for a Fan Testing Facility

Product	Test Procedure	ERDA estimate
Ceiling Fan	IS:374-1979	$7,800
Pedestal Fan	IS:1169 - 1967 Air delivery	$7,800.
Table Fan	IS:555-1979 Air delivery	$3,300 (chamber only)

2.4 Lighting

2.4.1 Ballasts

2.4.1.1 Ballast Efficiency Testing Background

There are several international standards for measuring the efficiency of ballasts. The European/IEC standards as well as regional standards in Asia are discussed here. Since ballasts are used with lamps and the final useful results of using a ballast is to power a fluorescent lamp, it makes sense to measure the efficiency of a ballast-lamp combination. This is especially true because a ballast may be more efficient with one lamp than with another. Ballasts are designed to be matched with a given type of fluorescent lamp.

The IEC ballast standards provide ways of measuring power and lumens, but they do not provide for an explicit metric for ballast efficiency, nor do they provide details on how to measure lumens of a ballast-lamp combination. The European Directive requires testing to the European Norm (EN) standard EN 50294, and this in turn refers to the IEC test procedures for ballasts.

Other regional test procedures in Asia measure the losses through a ballast without measuring the ballast with a lamp and measuring the light output of a ballast-lamp combination. While the advantage of this type of test is that it is easy to perform with basic equipment, it cannot be used with electronic ballasts and is not as good as testing a ballast with a lamp.

A brief discussion of the EN and IEC test procedures is given below as well as a protocol (ELI) for voluntary labeling compact fluorescent lights (CFLs) and ballasts.

European Directive 2000/55/EC

European Directive 2000/55/EC on energy efficiency requirements for ballasts for fluorescent lighting uses the European Committee for Electrotechnical Standardization (CENELEC) Standard EN 50294 of December 1998 to define the electricity consumption of a ballast. It is based on international standards. For the ballasts to comply with the energy efficiency requirements of this directive, the ballast must also bear the 'CE' marking.

The energy efficiency of the ballast-lamp circuit is determined by the maximum input power into the circuit. This is a function of the lamp power and of the type of ballast; for this reason, the maximum input power of ballast-lamp circuits of a given ballast is defined as the maximum ballast-lamp circuit power, with different levels for each lamp power and ballast type (ANNEX II or Directive 2000/55/EC, 18 September 2000) There are six ballast categories.

Standard EN 50294:1998

This European standard was approved by CENELEC on August 1, 1998. The Standard gives the scope as “the measurement method of the total input power for ballast-lamp circuits when operating with their associated fluorescent lamp(s).” It applies to:

- Linear lamps with power equal to or grater than 15 Watts
- Single-ended (compact) lamps with power equal to or grater than 18 Watts; and
- Other general purpose lamps

References to IEC performance standards include:

- IEC 60081, Double-capped fluorescent lamps-performance specifications
- IEC 60901, Single-capped fluorescent lamps – performance requirements
- IEC 60921:1998, Ballasts for tubular fluorescent lamps – performance requirements; and
- IEC 60929:1990, AC supplied electronic ballasts for tubular fluorescent lamps – performance requirements

The EN 50294:1998 test procedure requires both a reference ballast and a reference lamp. As part of the standard, the ballast lumen factor (BLF) needs to be measured and is required to be between the range of 0.925 and 1,0075. The BLF is defined as the ratio of the light output of the reference lamp when the ballast under test is operated at its rated voltage, compared with the light output of the same lamp operated with the appropriate reference ballast supplied at its rated voltage and frequency.

- BLF = (lumens with test ballast) / (lumens with reference ballast)

The accuracy of the measurement shown in Table 2.8 below must conform with EN 60929, A.1.2 and A.1.7.

Table 2.8 Measurement Accuracy for Ballasts

Ballast Type	Total Accuracy Including the Photometric Measurement	Correction to the Power Measurement
Magnetic wire-wound	**±1.5%**	BLF of 0.95
Electronic ballast	**±2.5%**	BLF of 1.00

The method of measurement for magnetic ballasts is EN 60921:1991 and for electronic ballasts is EN60921:1999, which is in line with IEC 60921 and IEC 60929.

In general, the equipment needed to test to the European directive consists of:

- Reference ballasts
- Reference lamps
- Photometric measurement device; and
- Instruments for measuring voltage, amperage, and power

The standard specifies the location of the photocell sensor and the lamp. It also shows in diagrams the location in the circuit to measure voltage, current, and power (Watts). Measurement in an Ulbricht sphere is accepted as an alternative to the arrangement illustrated in the test standard.

Note: With electronic ballasts, measurements of power losses of the ballast itself cannot be measured accurately. Therefore, only the total input power method (measuring whole ballast-lamp circuits) can be carried out.

IEC Standard 921 – Ballasts for Tubular Fluorescent Lamps – Performance Requirements

- Requires a reference lamp and reference ballast
- *Reference ballast* (described in Appendix C of the standard) is a ballast having specified characteristics as defined in IEC 921
- *Reference lamp* (described in Appendix D of the standard) includes a lamp that meets certain requirements after having been aged for at least 100 hours. Properties of the lamp must be within certain limits when tested with a reference ballast at an ambient temperature of 25°C
- In Section A6,c, the IEC standard describes measuring the luminous flux but not in detail. The standard also says that a photometric integrator is not required. The EN standard gives more guidance on this topic

IEC Standard 929 – A.C. Supplied Electronic Ballasts for Tubular Fluorescent Lamps – Performance Requirements

- Also requires a reference lamp and ballast as specified in IEC 929

ELI Requirements

ELI is a series of specifications that, when met, allow tested ballasts to use the ELI endorsement label. These specifications include a specification for efficiency. It basically refers to other test procedures, including EN and IEC test procedures. ELI protocol measures the efficiency of the lamp-ballast circuit in lumens per Watt (lm/W). It also determines a ballast factor (as does the EN standard), which is defined as the ratio of a fluorescent lamp's light output on a specific ballast, compared to the fluorescent lamp's output as measured on a reference ballast. In addition, it specifies requirements for power factor, warranty, and other safety and performance requirements.

2.4.1.2 Equipment Requirements for Ballasts

Typical ballast testing instrumentation and equipment with prices listed in US$ are given in Table 2.9. Table 2.10 provides typical testing instrumentation and prices for CFLs.

Table 2.9: Typical Ballast Testing Instrumentation and Equipment

Instrument/Equipment	**Brand**	**Specification**	**Price US$**
Reference Ballast (variable linear reactor) (two – for 2 ft and 4 ft lamps)	WPI Industrial Technology – VLR-2	Meet requirements of ANSI C82.2-1984 or IEC 928 & 929 or as specified in alternate standards	($2,376 each) $4752 total
V-A-W (Power Analyzer)	Voltech PM3300	**0.05%** accuracy; includes measurement of harmonics, PF	$10,000
Voltage regulators	Stabiline Voltage Regulator, model PPCX52110	max. Watts = 80 ∀ **5%** of nominal	$215
Variable transformer	Warner Electric 10C-12		$93
Photometer	Tektronix J18		$2,639
Thermocouple reader (temperature meter)	Omega MDSS41-TC		$820
Thermocouple wire – 1000 ft. roll	Omega TT-T-24SLE	24 AWG type T wire	$375

(1) from *Feasibility of an Appliance Energy Testing and Labeling Program for Sri Lanka* (2000).

2.4.2 Compact Fluorescent Lamps (CFLs)

Table 2.10: Typical Instrumentation for Compact Fluorescent Lamps

Instrument	**Price**
V-A-W Power Meter with harmonic analyzer Voltage Regulator	$10,000
Integrating Sphere	$75,000

(1) from *Feasibility of an Appliance Energy Testing and Labeling Program for Sri Lanka* (2000).

The equipment and testing requirements of IEC969 Appendix A – Self-Ballasted Lamp are listed below:

1. Draught-proof room (draught-free)
2. Ambient temperature 25 ± 1°C
3. Relative humidity of **65%** maximum
4. Test voltage ± **2%** at the moment of measurements

5. Total harmonic content of the supply voltage shall not exceed **3%**
6. Measure in a vertical base-up position; and
7. Age VPC lamps for 100h before tests

2.5 Electric Motors

Motor efficiency testing protocols differ around the world, and their application to any given motor can lead to significantly different efficiency values. Many countries with no domestic motor manufacturing capacity import motors from a variety of countries using different testing procedures. Test procedures include the International Electrotechnical Commission protocols (IEC 34-2), the National Electrical Manufacturers' Association (NEMA) protocols, which conform to Institute of Electrical and Electronic Engineers protocols (IEEE 112), the Japan Industrial Standards (JEC-37), and other protocols.

The different motor efficiency testing protocols produce different efficiency values due to the way in which stray load losses are evaluated. In North America, the NEMA standard provides for direct measurement of the motor efficiency; in other parts of the world indirect measurement methods are used. To summarize, there are two basic efficiency measurement approaches:

- Measure the input energy to the motor with a Watt meter and measure the output with a dynamometer; and
- Measure the input directly and measure the motor losses indirectly. The indirect method is especially popular for very large motors

Section 3 Test Facilities in the Region: Capabilities and Improvements

In this section, details of notes taken at each laboratory or institution are outlined. The testing capabilities are organized by country and then by laboratory in that country.

3.1 India

3.1.1 Bureau of Indian Standards (BIS) — Delhi Headquarters

The Bureau of Indian Standards (BIS) is under the Ministry of Consumer Affairs. This bureau establishes standards under a Standards Advisory Committee. Under this Standards Advisory Committee, there are a number of Divisional Councils that are responsible for specific technology disciplines, such as electrotechnical, chemicals, etc. Under each Divisional Council, there are specific technical committees, such as the transformer technical committee. Acceptance of revisions or new standards is based on consensus and not just a majority vote. The BIS is organized into eight regional laboratories. In this report, we describe the Sahibabab Laboratory as well as the Delhi headquarters.

The BIS offers voluntary recognition for meeting various parameters including performance and energy efficiency levels set in the BIS standards. The test standard defined here, includes the method of test as well as levels of performance a product has to meet to qualify for an IS Mark, which is a label issued by BIS indicating that a product has met the criteria set by BIS.

For some products, BIS uses outside laboratories for testing, such as, Electrical Research and Development Association (ERDA), CPRI, RTC, etc. They also use the services of the National Physical Laboratory (NPL), which is the national measurement reference laboratory for India.

The BIS generates its own revenue, but it is a non-profit institution. Any surplus is supplied back to the Government. Most of the revenue is generated through the certification label. There is a minimum charge based on the operational cost to provide the certification. Additional charges are based on the production on a per unit basis. Secondary sources of income are the sale of standards and training programs.

Although BIS issues many test procedure standards, it does not have the resources or capabilities to test all of these products. The BIS has standards for both self-ballasted and single-cap CFLs. The BIS reports that the IEC test procedure does not include lumens or harmonics, but it has added performance parameters to the IEC standards.

Fan test procedures are in-line with IEC, but additional performance criteria were added.

Motors are in line with IEC 34-1 (1984); however, the BIS standard is not fully aligned with the IEC revised standard in 1996.

The BIS maintains that the refrigerator standard is "in-line" with ISO; however, it does not require test packs, which is a significant deviation.

3.1.2 Bureau of Indian Standards (BIS) – Sahibabad Laboratory

The Sahibabad laboratory is the largest of the eight regional BIS laboratories.

Refrigerators

- It formally had a test facility to test refrigerators, but because of lack of demand it was shut down

Fans

- It has a set up to test ceiling fans, including airflow per IEC and BIS test procedures
- The exhaust fan tests are performed as per the BIS standard
- Airflow is not corrected to standard temperature and pressure

Lamps/ Lighting

- Fluorescent lamps and ballasts are sent to NPL for testing
- Capability avails to test incandescent lamps

Equipment:

- A photometric integrating sphere that is calibrated at NPL once a year, is currently used to test incandescent lamps only
- Life tests are currently done for incandescent but not CFLs

Motors

- BIS has standards for motors: (1) induction, and (2) high efficiency motors
- Facility avails to test motors up to 15 kW using the input / output method of IS-325
- Equipment includes an old Siemans motor tester and some analog amperage meters
- For larger size motors – a method that measures all losses is used (some assumptions must be made with this method)

Quality Control and Calibration

- BIS has a Quality Manual and a Procedures Manual as per requirements of ISO 17025
- BIS is equipped with its own mechanical calibration laboratory
- For specialized calibration, it depends on NPL or ERTL
- Also equipped with volt, amps, and resistance calibrators, including Rotek instruments
- Calibration of other faculties is not undertaken by BIS and only calibrate instruments at BIS due to lack of time to undertake extra work

Other and General Observations

- In general BIS has many analog meters that should be upgraded to digital meters
- The BIS laboratory has its own power generation because the utility power is unreliable
- To condition the test rooms, BIS uses either a window air conditioner or a split system air conditioner with a single thermostat in an on/off operation

What can SARI/Energy do to help?

When asked what SARI/Energy could do to assist, the response was, "Hold a workshop to help promote high efficiency motors."

What would be needed to test products in the SARI/Energy program?

- **Refrigerators**: A complete refrigerator test facility would be needed – space is available
- **Fans:** The existing equipment is adequate for ceiling fans and exhaust fans. Facilities to test pedestal and table fans are needed. Space does not seem to be a problem
- **Lighting:** It depends on the test procedure selected; a small sphere for incandescent lamps is currently used every day. New equipment to test ballasts, CFLs, and fluorescent tube lamps is required
- **Motors:** Some motor testing capability exists; however, equipment (including power measurement equipment) needs upgrading, especially for new electronically controlled motors

3.1.3 Electronic Regional Test Laboratory (North) – ERTL(N)

The Electronic Regional Test Laboratory (North) [ERTL(N)] is under the Ministry of Communications and Information Technology. As part of its purpose, it assists the electronic and electro-technical industry in India to be internationally competitive. This includes testing, helping manufacturers to modify their designs and retesting to meet, for example, EMC and EMI requirements for Europe. Manufacturers' product tests are carried out at ERTL's facilities. Since test facilities are costly, ERTL does not build test facilities, but it helps others set up their own calibration laboratories and assists in obtaining NABL accreditation.

Refrigerators

ERTL has a Weiss walk-in environmental chamber (imported from Germany), which can be used as a refrigerator test facility. It was not specifically designed for this purpose but for temperature control of electronic components or circulate to other small chambers. It is basically, a large temperature and humidity controlled sealed chamber with a return air register at the bottom and two axial fans supplying air at the top of the wall opposite the door to the chamber. Controlling the temperature and humidity is a single temperature and RH probe.

Specifications on the Weiss walk-in chamber are
- Electronic humidity sensor
- Humidity tolerances: +**2%** and –**3%**
- Temperature tolerance: ±1°C (they can be bought with 0.5C tolerance)
- Volume of chamber is 20 cubic meters; and
- Cooling system is a DX cooling coil

Concerns are that the temperature cannot be held to the 0.5°C tolerance and that the airflow will be too high in the vicinity of the refrigerator. It remains to be seen if the chamber can be modified to decrease the airflow to the test procedure requirements and to still meet the temperature stratification requirements. When it was visited, ERTL(N) had not run a refrigerator test, nor was a refrigerator and data acquisition set up. When using a chamber such as this, it would cause temperature problems when one enters the test chamber. A test room with a vestibule with two sets of doors would be preferable.

ERTL(N) reports that they have the capacity to test two refrigerators at a time. The duration to test one refrigerator is one week.

ERTL was chosen to be the home laboratory for the inter-laboratory refrigerator proficiency testing. The other seven or eight laboratories are mostly manufacturers. The entire round-robin testing is expected to take one month.

Fans

ERTL can test fans but not for air velocity. It can use Quality Assurance to witness test other laboratories to ensure the tests are carried out correctly. This testing is under study.

Lighting

Ballasts
ERTL can test a ballast in one or two days per the Indian Standard (IS) 1534 (part 1) test standard, which claims to be the same as the IEC test.

CFLs
ERTL can also test CFLs. Intensity is measured in lux. For color temperature they sub-contract through a subsidiary.

Lamps and Ballasts
Color and harmonic tests are conducted by NPL for ERTL.

Quality Control and Calibration

Internal calibration structure of ERTL(N) is divided into three parts: electrotechnical, non-electrical, and high precision calibration center (HPCC). At HPCC, high precision calibration center of ERTL conducts energy and electrical measurements as accurate as NPL.

International accreditations include:
- NSI laboratory (ITL) under IECQ 26 member countries
- FCC listing for EMI/EMC (on list of approved facilities)
- IECEE-CB scheme (IEC electrical equipment scheme)
- World Health Organization (WHO) vaccine carriers

National accreditations include:
- NABL accredited for calibration and for testing
- Conducts IS mark testing for BIS
- Safety certification scheme, STQC
- EMC compliance certification Scheme, STQC

ERTL(N) has auditors that accredit other laboratories; four or five engineers are assessors for NABL for calibration and testing, and they also perform consultancy for ISO 17025.

Other and General Observations

- Training programs including training programs for foreigners are being undertaken by ERTL(N)
- ERTL(N) is also represented on the BEE steering committee
- Headquarters finances new laboratories based on the input of the local area committee. It also looks at the return on investment, cost, and number of customers

Process for a Customer to Obtain Testing
- The customer fills out a request form and ERTL(N) provides a price quote and an estimated time of completion (or they can send the requirements)
- If the product is not in compliance, the laboratory provides a report with the test results – if the product passes, a report to indicate the test was satisfactory, is issued

General Assessment
- The laboratory has good instruments for high precision electrical calibration
- There is no photometric capability
- No ducted room air conditioners are available to keep the rooms at constant temperatures (only window air conditioners)
- It is equipped more to conduct safety tests and EMC/EMI requirement tests

What can SARI/Energy do to help?

SARI/Energy can educate consumers about the benefit of high efficiency appliances.

What would be needed to run tests of SARI/Energy interest?

ERTL(N) has very accurate calibration and electrical measurement instruments and equipment. It has yet to set up facilities for testing of refrigerators, fans, motors, or all of the tests for fluorescent lamps, CFLs, or ballasts. The testing requirements for lighting have not been spelled out in detail yet.

3.1.4 Regional Testing Centre (RTC) Laboratory

The Regional Testing Centre (RTC) laboratory is under the Government of India and its Ministry of Small-Scale Industries. Its purpose is to help small manufacturers. Although one staff member was enthusiastic to test lighting products and refrigerators, the general view is that since refrigerators are not manufactured by small manufacturers, it would not fall under the purview of this laboratory. RTC mostly conducts safety and performance tests with an objective to help small industries to succeed. Electrical, mechanical, metallurgy, and chemical tests are included in these safety and performance tests.

Refrigerators

- RTC does not test refrigerators

Fans

- RTC has a ceiling fans test setup

Lighting

- RTC tests magnetic but not electronic ballasts
- Incandescent lamp testing is performed
- Future plans are to add a CFL testing facility that will be able to test to both IEC and Indian Standards (IS)

Motors

- Installation is equipped with a small motor test setup for fractional horse-power motors

Quality Control and Calibration

- RTC is NABL accredited and also recognized by BIS for entire product certification
- Instruments are calibrated by NPL or a NABL approved laboratory. It has one assessor and lead auditor trained by INTEK, which is an organization that trains auditors. This was funded by the UN

Other and General Observations

- The laboratory will be converted to a climate-controlled laboratory (Note: this probably will be room air conditioners)

3.1.5 Electrical Research and Development Association (ERDA)

The Electrical Research and Development Association (ERDA) is a co-operative research institution, created by the Indian Electrical Industry and Utilities with the support of Governments of India and Gujarat. The laboratories stand in a sprawling area of 25 acres. This is a non-profit co-operative organization. The laboratory undertakes testing, research, and development of products and processes, calibration, training, etc. It has received recognition from various organizations in the government and public sectors, and from UL, CSA, and IECEE-CB Scheme of IEC for testing in various electrical fields, including electrical appliances. ERDA has NABL accreditation. It also offers calibration services for various measuring instruments in electrical, physical, and thermal parameters. It follows the Indian Standards (BIS Standard), IEC / ISO Standards, and BSI Standards as per the requirement of the client. The turn-over is about Rs 10 Crore. Total jobs handled is about 6000 per annum, and regular clients are about 2000.

Refrigerators

A new test facility is being planned and should be completed in one year. This will be a new building and within the building a test room specifically designed to test refrigerators. It will have a perforated ceiling to supply air and other design considerations to provide temperature and humidity and air flow within the specifications in the ISO test procedure ISO 8561 for frost-free refrigerators. The test facility will be designed to test two refrigerators at a time. The prefabricated test chamber will be 5m (length) by 3.5m (width) by 3m (height). The cooling system will be able to remove 1000 Btu/hr. Cooling will be accomplished by a chilled water loop. A perforated ceiling will be used with the return air in the floor. The airflow will be under the maximum allowed of 0.25 m per second.

ERDA contracted with KASCO Industries, a company that has designed refrigerator test facilities for manufacturers. The cost will be 3.5 million Rupees (US$ 77,778). KASCO Industries will design, build, and commission the refrigerator test facility. Financing was arranged through a loan from ICICI to develop test facilities for both refrigerators and air conditioners.

Fans

ERDA formerly had a ceiling fan airflow measurement facility, which was removed. It could easily be set up again on short notice.

ERDA provided the estimated costs for setting up an air delivery test for air circulator fans, table fans, ceiling fans, and AC ventilating fans. ERDA already has the capability to run other tests for these types of fans to IS test procedures. Table 3.1 lists the costs to meet different test procedures for various types of fans.

Table 3.1 Facilities for Establishing Air Delivery Tests

Type of Fan	Test Procedure	Cost
Air Circulator Type Electric Fan	IS: 2997-1964	3.5 Lacks Rs ($7,800)
Table Fan (Only Chamber)	IS: 555-1979	1.5 Lacks Rs ($3,300)
Ceiling Fan	IS: 374-1979	3.5 Lacks Rs ($7,800)
AC Ventilating Fans	IS: 2312-1967	1.0 Lacks Rs ($2,200)

Lighting

Capabilities exist for testing:
- Tubular fluorescent lamps
- Ballasts for safety, performance, harmonics, V,A, pf
- Electronic ballasts for tubular fluorescent lamps; and
- Using IS and IEC standards

The available equipment includes:
- 1 meter integrating sphere with barium sulfate coating
- 2.5 meter integrating sphere with barium sulfate coating
- Instruments to read lumens, Watts, PF, voltage, and current (Some equipment is from Delta Control Engineering of Mumbai; They seem to have good digital meters.)
- Calibrated lamps from NPL (all types of lamps with different Wattages; see IS2418 / IEC equivalent)
- Photocell (photometer) from Minolta and calibrated by NPL
- Goniometer built by PRC Krochmann (Germany)
- Aguelaut 6813B measure Power (measures to 58 harmonics and includes measurement of the crest factor)
- Calibrate the color coordinate instrument using NPL calibrated lamps; and
- Lamp data is fed into a computer

Other Observations

- ERDA is NABL accredited for measurement of CFLs, lamps, and ballasts
- Without a life test or aging the lamps, testing takes about two days per test for CFLs and tubular fluorescent lamps (includes all of the tests – not just energy efficiency)
- It takes about three days to do all the tests for a ballast
- Lamps are aged for the purpose of performing an output loss test

Motors

Testing Capabilities:
- ERDA can test motors from sizes of 180 Watts minimum to 30 horsepower maximum
- Testing is performed to IEC standard 34; motor data is fed into a computer
- ERDA has NABL accreditation for testing motors, which can test three sets of three motors at a time and takes 8 hours per test to test one motor and operates two shifts

for motor testing, i.e., the sample is three motors that are the same or two different motors at a time can be tested

- Testing includes both three-phase and single-phase motors. The data acquisition is in C language. The instrumentation was calibrated a year ago by an NABL accredited calibration laboratory
- The dynamometer available at ERDA can test motors of the following rated horsepower: 0.5, 1, 5, 7.5, 15, and 30
- The set-up can be modified to test any three of the above capacities

Quality Control and Calibration

- ERDA is accredited by NABL

Other and General Observations

- ERDA can assist others to set up laboratories
- Due to the lack guaranteed future work load to test refrigerators, it would be difficult for ERDA to risk a large investment to build an adequate refrigerator test facility. It would be beneficial if they had a contract to do a minimum amount of testing over a time period in the future

What can SARI/Energy do to help?

- SARI/Energy should improve the awareness of the labeling program and provide financial assistance

What would be needed to run tests of SARI/Energy interest?

- Build a refrigerator test facility
- Build fan air delivery test facilities

3.1.6 Consumer Education and Research Centre (CERC)

The Consumer Education and Research Centre (CERC) is a consumer organization whose objective is to protect the consumer by testing consumer products in an unbiased manner. CERC also publishes the magazine "*Insight,*" which provides results of consumer product testing. In the past, CERC has been given funds by the United States Agency for International Development (USAID) and UNDP to build test facilities.

Refrigerators

Testing capabilities:

- The testing room is approximately 1000 cubic feet in size
- The facility can test one refrigerator at a time, use the IS test procedure, and meet the temperature gradient requirement
- Shiva of India supplied the in-room air conditioning equipment. It has return air at the top and supply air at the bottom. The room ambient temperature and humidity

conditioning apparatus is an all in one cabinet and includes a DX coil, a heating coil, and a humidifier

- CERC personnel reported that the refrigerator room temperature and humidity control is manual, but data collection is computerized

Comments on refrigerator testing capability:

- Information from other sources intimate that CERC has only run one refrigerator test and not to any standard test procedure
- A test in progress was not observed, but it appeared from the test room that the maximum airflow around the refrigerator would be a concern, as would the temperature gradient. It may be possible to retrofit this room to achieve more uniform and low velocity air distribution
- The temperature control should be automated; as the refrigerator test duration in a BEE specified test procedure is at least 24 hours in duration
- Other international experts are concerned that the results from this test facility would not correlate with other test facilities

Fans

CERC has modern test facilities to test ceiling, pedestal, and table fans to IS and ISO/IEC Standards. An exhaust fan testing facility is also available. The ceiling fan and pedestal fan testing is automated to move the airflow anemometer along a track, as specified in the test procedure.

Ceiling, Pedestal, and Table Fan Testing:

- The test facility is equipped with Delta voltage stabilizing equipment and Aplab manual frequency control equipment
- Test data is fed directly to a computer
- The fan test instrument room has conditioned air
- Instruments in the fan testing room are calibrated once a year and are traceable to NPL
- CERC has tested 15 ceiling fans

Exhaust Fan Testing:

- These are tested to IS Standards
- A Testo brand vane type anemometer is used

Lighting

- CERC has the capacity to test lamps with one large integrating sphere and one small integrating sphere. It can test one at a time; one lamp test takes about three days
- It can test magnetic ballasts and some tests for electronic ballasts – lumens per Watt

    - CFL tests are carried out according to IEC standards; life testing: 10 brands x 10 per brand

- Tubular Fluorescent Lamps:
  - Tubular fluorescent lamps are tested according to IEC and IS test procedures
  - Voltage and frequency can be regulated - Behlman A/C power source
  - German instrument ALTEEM (accurate) feeds results to a computer

- Tubular Fluorescent Lamp Life Testing:
  - It has the capability to test 10 brands x 10 per brand
  - All lamps are connected to both a voltage regulator and a UPS
  - A photocell detects the failure of a bulb
  - An outside engineer wrote the life test data acquisition program

Electric Motors

CERC is set up to measure pump motor sets, but it can measure motors separately as well. Motor test capability is from 0.5 to 20 hp. The single phase however, needs an employee to carry out the tests.

Quality Control and Calibration

CERC has filed an application to NABL to get ISO 17025 approval and is now obtaining assistance in putting together the Procedure and Operation Manuals.

Other and General Observations

- It approaches funding agencies, e.g., UNDP and USAID, as an independent organization without industry and government connections
- CERC cannot raise or borrow money
- Space for testing is not a problem

General Information

- CERC has a total staff of 89, of whom, 79 are technical people including editors
- The laboratory personnel includes a total of 20 people, of whom, 10 are non-technical operators
- CERC does its own training, although but courses developed by ERDA is used
- Use of outside consultants is limited unless it is required to build a laboratory that has a special need

What can SARI/Energy do to help?

- The authors suggest training of personnel and funds for testing appliances at regular intervals

What would be needed to run tests of SARI/Energy interest?

- Modify refrigerator test facility
- Provide training; and

- Provide additional equipment needed for an additional lighting test (i.e., harmonic measurements for lighting)

3.1.7 Central Power Research Institute (CPRI)

The Central Power Research Institute (CPRI) describes itself as a premier research organization in electrical power engineering in addition to functioning as an independent testing and certification authority for electrical equipment and components. CPRI, an autonomous society, registered under the Ministry of Power, was established in 1960 by the Government of India. The main objective of the institute is to serve as a national laboratory for undertaking applied research in electrical power engineering; in addition, it functions as an independent testing and certification authority for electrical equipment and components to ensure reliability and improve, innovate, and develop new projects. The head office of CPRI is in Bangalore.

Although CPRI is a Government of India owned laboratory, new capital projects are funded from loans and CPRI is responsible for repayment. Discussion and a tour of relevant facilities were provided by the Electrical Appliances Technology Division (EATD) of CPRI. Of immediate interest are four of the seven departments of the EATD.

Refrigerators

CPRI tests refrigerators for electrical parameters and uses a walk-in environmental chamber currently used in the cable testing department to test refrigerators. The environmental chamber has compressors that chill water. Temperature is controlled to ± 1°C and relative humidity to ± **2%** RH. When CPRI gets some refrigerator work, EATD will order a 10 ft x 10 ft x 10ft environmental chamber specifically to test refrigerators. In addition to the energy use tests for BEE, CPRI also plans to test refrigerators for condensation and ice-making tests.

Equipment:

- Fluke Multiplexer and Data Logging System

- Environmental Chamber 1
  - Blue Star (India) Teriney WIL-H-1000
  - Controls seem to be on/off control and not PID or proportional
  - Chamber dimensions are 3m x 3m x 3m
  - Chamber 1 was purchased a long time ago for about 41 lahks

- Environmental Chamber 2
  - Brahender (German)
  - Chamber dimensions are about 6ft by 6 ft

- For both environmental chambers the supply air is at the top of the conditioning equipment cabinet with the return air at the bottom

Observations

BEE draft standard requires the ambient temperature to remain in the range of 32 ± 0.5°C. Therefore, chamber 1 does not meet the temperature tolerance requirements. Although CPRI claims that there will be no turbulent airflow around the refrigerator to meet all of the test parameters, based on the existing environmental chambers, modifications would most likely be needed to meet the BEE energy efficiency test standard requirement. CPRI does not have a history of performing energy efficiency tests on refrigerators but appears to have the technicians who are capable of running a test. Proficiency testing and accreditation are recommended. The proficiency testing should include a round-robin test, preferable on more than one kind of refrigerator.

Ceiling Fans

CPRI has a test facility to test ceiling, pedestal, and table fans to the IS/IEC test procedures. The instrumentation for pedestal and table fans is essentially the same, and they would be able to test these as well. Instruments to measure power and air delivery are required to test fans. Listed below are details of this instrumentation.

- Power Measurement
  - Instrumentation is by ENERCON

- Air Delivery Measurement
  - CPRI uses a mechanical vane type anemometer as specified in the IEC and IS test procedures. The IS-374-1979 airflow shall be measured by a rotating vane anemometer
  - The anemometer has low velocity capability; its measurement threshold is 0.28 m/sec and it is calibrated over the range of 0-300 meters per minute
  - The anemometer brand is M/s Casella London, C-9641 (made in England)

- Air Delivery Calibration
  - The anemometer is calibrated in Pune, in a wind tunnel operated by the Indian Government Meteorological Department
  - The anemometer is calibrated once a year – the calibration is valid for one year – the anemometer is stored in a locked cabinet
  - It takes 2-3 days to have the anemometer calibrated, but CPRI books the time in advance

- Test Conditions
  - The fan test is run at room temperature
  - The test procedure says that the temperature should be less than 40°C in the chamber and does not require correction factors for the barometric pressure and temperature of the air

Discussion

Although the IS and IEC test procedures say to use a vane type anemometer and some claim that an alternative, a hot wire anemometer, is not good for low flow air measurement, the CSA standard suggests using a hot wire anemometer. Other researchers have also used a hot wire anemometer.

Lighting

CPRI is equipped to test luminaires, tubular fluorescent lamps, CFLs, electronic and magnetic ballasts.

Lamps

Equipment and Instrumentation:

- Integrating sphere:
  - The laboratory has a 1.5 meter photometric integrating sphere that can measure lumens and lux for CFLs and GSL lamps
  - The sphere needs new paint on the inside
  - The photocell feeds into a Colorimeter 420 made by PRC Kratzman of West Germany, 1990. It can measure lux and lumens
  - Calibrated lamps are calibrated by NPL

- A rectangular integrating chamber (second photometer) that measures about 6 ft x 3 ft, is used for *tubular fluorescent lamps*

Life Testing:

- Life testing is for four batches of 40 lamps or tubular lamps
- For GSLs, testing is done for 20 samples of six batched each
- More life testing capability could be added

Ballasts

- Electronic and electromagnetic ballasts can be tested
- Reference electromagnetic ballast is calibrated by Universal Lighting Industries of Bombay

General

- Equipped with both frequency and voltage stabilizers, capacity to 5kV – Servitronics brand (an Indian model)
- A sine wave frequency converter and an Oscilloscope are available
- The lighting room is cooled by a room air conditioner to 25 ± 2°C
- The harmonic content of CFLs, electronic and electromagnetic ballasts is measured with a BMI brand meter to the 50^{th} harmonic, which is hooked up to a computer interface

- A mains transient test for electronic ballasts (to see if electronic ballasts feed transients back into the main electrical lines feeding the ballast) is done. The equipment used for this is by Schaffner of Switzerland

Electric Motors

CPRI is equipped to test fractional motors up to 30 hp. Upgrading of this facility to increase the FHP motor testing capabilities is underway.

- The motor efficiency is determined by the calculation method; the input = output + all the losses; i.e., sum of the losses method, IEC and IS
- I it equipped with a generator for 3-phase to 30 horsepower (hp)
- A motor is loaded to its rated power and a temperature measurement of the coil is taken by using the resistance method
- There is a DC generator – AC 3-phase generator
- Applied for accreditation to test motors

Quality Control and Calibration

- CPRI uses NPL, ETDC, Boor calibration of equipment.
- It has temperature and RH chambers, but it needs to be an NABL accredited refrigerator test facility
- An NABL audit is good for one year
- Internal audits of test facilities are conducted
- CPRI is accredited for ISO 17025 and have a Department Quality Manual and a Divisional Quality Manual
- CPRI is also an NABL accredited laboratory and its divisions are accredited separately
- Accreditation:
  - Illumination is accredited for Indian standards
  - Fan testing is accredited
  - Refrigerator testing accreditation has been applied for
  - Motor testing is not currently accredited

What can SARI/Energy do to help?

- No requests were forwarded

What would be needed to run tests of SARI/Energy interest?

- The environmental chambers identified for testing of refrigerators may not be adequate – thus, a refrigerator test facility needs to be set-up
- Fan testing is adequate
- Requirements for lamp testing seems adequate but needs round-robin testing

3.1.8 Indian Institute of Technology (IIT) – New Delhi

The Indian Institute of Technology (IIT) is a Federal University, which has seven locations. The purpose is teaching, research, and supporting industry. This refrigerator laboratory was established in 1993 with the phase-out of CFCs and now conducts appliance testing work for industry to increase efficiency. Currently, the room used to test refrigerators is not specifically designed for that purpose; however, the plan is to upgrade the test facilities with funds from the University and perhaps some outside funding, if possible.

IIT plans to build a refrigerator test room with perforated ceiling for even cooling. It also plans to have total standby power capacity localized for just the laboratory.

Refrigerators

Equipment and instrumentation:

- Equipment is all digital
- The voltage stabilizer and UPS are good up to 7.5 kVA
- There is a frequency stabilizer
- Data is recorded on the computer every 15 seconds
- It has a 16-channel data-logger "Datataker" (German brand)
- The power meter brand is HB (German); instruments were provided for a project in 1994
- Internal refrigerator temperature measurements are being made with RTDs (no brass or copper weights are used)
- The RTD wires are passed by a door magnetic strip, and the area around it is taped
- Repeatability of the refrigerator test has been checked
- IIT has used ISO test packs for the freezers in the past

3.1.9 Bureau of Energy Efficiency (BEE), Government of India

The Bureau of Energy Efficiency (BEE) is responsible for carrying out the appliance energy efficiency standards and labeling programs in India. (http://www.bee-india.com/monitoring/standards.html)

BEE would accept the results from test laboratories outside India if they were accredited by the International Laboratory Accreditation Cooperation (ILAC) or Asia Pacific Laboratory Accreditation Cooperation (APLAC), but it does not have any mutual recognition agreement (MRA) or memorandum of understanding (MOU) to that effect.

Standards and Labeling Process

BEE suggested the following order for the appliance and lighting labeling process;
1. Develop test protocols
2. Identify testing laboratories
3. Accreditation of identified laboratories

4. Harmonize test protocols

BEE stated that testing can take place in any accredited lab, but the laboratory needs to be accredited for the particular test procedure.

Accreditation

- The test laboratories that will be used for check testing and/or dispute resolution will need to be NABL accredited (or ILAC). Accreditation is also strongly recommended for manufacturers' laboratories but not included in the regulation
- The purpose of accrediting test laboratories is to identify whether accurate results are produced
- NABL will have to accept other laboratories if they are accredited by accreditation bodies that are signatories of APLAC or ILAC
- BEE will accept the results of other laboratories if these laboratories are accredited by APLAC or ILAC
- ILAC will require comparisons with three other laboratories – thus ILAC accreditation will take care of proficiency testing
- All disputes related to test results submitted by manufacturers, will still be resolved by an Indian NABL accredited independent test laboratory – enforcement details are not worked out yet
- The refrigerator proficiency test will begin shortly

3.1.10 Voluntary Organization in Interest of Consumer Education (VOICE)

The Voluntary Organization in Interest of Consumer Education (VOICE) is a consumer organization that also publishes the magazine "*Consumer Voice*". VOICE reports on the performance on consumer goods but contracts with others to do the testing. It does not have its own testing facilities. VOICE sends the manufacturers a test program before running the test and then gives them one month to respond on the method of testing. It also sends the manufacturers the results after testing. Future plans include testing motors and lighting appliances.

It does not appear that VOICE will be an active part of the BEE testing program but will continue to check on product claims made by others.

3.2 Sri Lanka

3.2.1 National Engineering Research and Development Centre (NERD)

The National Engineering Research and Development Centre (NERD) was established in 1974 under the Sri Lanka State Industrial Corporation Act. NERD has a statutory board under the Ministry of Economic Reform, Science and Technology. It is located on nine acres of land and has a workforce of more than 400, of whom nearly 50 are qualified engineers.

The big projects at this centre are lamp testing and solar PV and solar home system testing. Testing includes: PV panels, inverters, batteries, and lamps (i.e., the whole system for a rural installation). The centre has received funds from the UNDP and the World Bank for capacity building. For testing and consulting, a fee is charged. Some assistance for setting up of the PV testing facility was provided by ETDC, a test laboratory in Bangalore, India.

NERD is located outside Colombo and is situated on a large campus with space for expansion. NERD has six engineers in Department of Electrical and Electronic Engineering and four technical assistants. The consulting fees cover their costs.

Lighting

Compact Fluorescent Lamps (CFLs)

There are three manufacturers of CFLs in Sri Lanka. NERD does tests for these manufacturers so that the manufacturers can improve their products. The test report includes color, power factor, etc. CFL importers also have their products tested at NERD. Lifetime tests are not currently performed at NERD due to a lack of demand for this test. Unlike for GSL, there is no accelerated test procedure for a CFL life test and the manufacturers do not want to wait (or perhaps pay for) the length of time a conventional life test would take. Should a demand for this test materialize, it could easily expand the capability to run life tests too.

Since all CFLs now sold use electronic ballasts (as compared to ferro-magnetic), NERD has the instrumentation to test CFL and electronic ballasts.

The primary electric utility in Sri Lanka, Ceylon Electricity Board (CEB) has a voluntary scheme for labeling CFLs. This program allows consumers to purchase lamps from qualified suppliers and pay the cost of lamps in installments with the monthly electricity bills. Only labeled lamps would qualify for this program. Lamps are tested by NERD (only institution equipped for testing of CFLs) and labeled by SLSI. The SLSI test protocols for CFLs is in line with IEC 969:1998 . However, for energy labeling a new Sri Lankan standard, SLSI 1225:2002, is used.

Ballasts

The CEB also has an energy efficiency labeling scheme for ballasts but not the capability to test electronic ballasts. Therefore, all electronic ballasts are given a five-star rating. SLSI does testing for electromagnetic ballasts using the SLSI test procedure standards (SLS 1200: 2001). Since SLSI is able to conduct the tests for electromagnetic ballasts, NERD activates are confined to testing of electronic ballasts.

However, for NERD to conduct a complete test on an electronic ballast, an electronic reference ballast and a reference lamps are required, and it plans to procure these from Lumintrox of Bangalore, India.

Tubular Fluorescent Lamps

NRED plans to test fluorescent lamps (T5, T8, and T12 lamps up to 52 inches in length) but it needs a reference ballast and a reference fluorescent tube lamp.

Equipment:

- Photometric Integrating Sphere
  - It is 75 inches in diameter
  - Maximum size of tubular fluorescent lamp that can be tested is 52 inches
  - Manufacturer is Labsphere – USA model LM760; comes with photometer
  - Data is recorded on a computer
  - NERD includes color measurements

- Power Analyzer model PM3000A
  - Power records up to 97th harmonic

- Other equipment and test setup notes
  - A clean AC source to stabilize the voltage, “Chroma programmable,” keeps the power source within test procedure standard requirements of 0.3%
  - Power measurement is calibrated every year at ITI (calibration laboratory)
  - Temperature requirements of 25±1°C are met with a room air conditioner
  - Lamps are aged 100 hours; thirty can be aged at a time
  - Maximum lamp Wattage is 5000 W
  - Spectral range is 350-1050 nm

- Photometric measurements that can be made:
  - Total luminous flux
  - Spectroral flux
  - Radiant flux
  - Color characteristics
  - Color rendering index
  - Chromaticity coordinates
  - Luminous efficacy

- Electrical characteristics that can be measured:
  - True power
  - True RMS current
  - Harmonics up to 99th
  - Power factor

Other Lighting Notes:

- SLSI standard for labeling of CFLs specifies the power factor should be more than 0.5
- The pin type lamps (as compared to the US popular screw in type) is popular here for CFLs and other lamps
- Flux distribution cannot be done – need a goniometer for luminaries

Calibration Facility (In-House):

- Programmable DC PSH output – TSX1820P
- Data acquisition: Agilent 34970A, current and voltage
- Digital Power Meter: Yokogawa WT 110
- Keithley Multimeter/data acquisition 2700 multimeter
- Hewlet Packard Oscilloscope

Quality Control and Calibration

NERD gets its instruments calibrated at Industrial Technologies Institute (ITI) in Sri Lanka. SLSI also does calibration at its metrology laboratory.

NERD has not entered into any MRA to date and suggested that if the laboratory is accredited, then no MRA would be necessary.

Calibration and Traceability at ITI:

- ITI calibrates their own instruments
- Integrating sphere is calibrated against ITI lamps
- The standard lamps were provided by the supplier of the sphere (unlike in India where NPL supplies a standard lamp)

NERD prefers a calibrating authority in Sri Lanka that would be similar to the NIST in the US or India's NPL (National Physical Laboratory). This would allow all calibration to be traced back to one national standard.

Other and General Observations

- The electricity supply frequency is steady (unlike in India)
- Voltage fluctuation is about **6%** – NERD has its own transformer

The centre has space for expansion, adequate technical personnel, and would be interested in testing other products, such as, fans, if required.

UNIDO/UNDP funded a separate department of NERD, the Energy and Environment Management Centre, to do energy audits. To date, it has audited 100 sites, mostly commercial sites, such as banks. Testing of appliances fits well with the goals of this program.

What can SARI/Energy do to help?

- NERD would like to have additional equipment
- It would like to expand its facility to cover testing of tubular lamps and luminaries (need goniometer for luminaires). This would cost about $30,000 to $40,000

What would be needed to run tests of SARI/Energy interest?

- NERD does not test refrigerators, motors, or fans because other laboratories to conduct these tests
- It needs reference electronic ballasts and lamps
- An electronic reference ballast would cost about $2,500, but an updated quote at the time of purchase is needed

3.2.2 Sri Lanka Standards Institute (SLSI)

The Sri Lanka Standards Institution (SLSI) is the National Standards Body of Sri Lanka, established under the Bureau of Ceylon Standards Act of 1964. The Institution functions under the Ministry of Science and Technology and is governed by a Council appointed by the Minister in terms of the Sri Lanka Standards Institution Act of 1984. SLSI by virtue of being the National Standards Body in Sri Lanka is a member of the International Organization for Standardization (ISO), which is based in Geneva. As a member of the ISO, national standards body exchanges, on a reciprocal basis, copies of their national standards and are responsible for disseminating information on standards, technical regulations, and standards related activities to the community at a national level.

SLSI has a product certification scheme that does testing and issues the SLS mark that shows compliance with their test standards. This is a voluntary mark except for twenty products locally manufactured that have been mandated through the directions issued by the Commissioner of Internal Trade to meet the SLS mark requirements.

Refrigerators

- Test Procedure standards at SLSI are based on ISO; however, there are significant differences. This test procedure is in the process of being harmonized with the Indian test procedure
- SLSI does not have any refrigerator test facilities
- The refrigeration laboratory will be funded by the World Bank and will be located at a CEB property
- The level of refrigerator efficiency needed to get a given star rating, still needs to be determined

Fans

- SLSI does not have space or land for expansion for performing air delivery tests on fans. However, it performs safety and other tests

Lighting

Tubular Fluorescent

- Tests are being carried out to the IEC standard but not labeled

Ballasts

- SLSI has efficiency ratings for electromechanical ballasts but not for electronic (automatically receive 5-star if it meets the IEC performance and safety requirements)
- SLSI does not have any reference lamps to measure actual energy consumption for ballasts
- It has an integrating sphere used for measuring GSL lamps, but CFLs and fluorescent tubes are tested at NERD
- If testing laboratories have calibrated instruments, it can be a part of the SLS marking scheme
- SLSI also does calibration of V, A, Watts meters.
- CEB also has some good instruments, but has no traceability
- The Sri Lankan ballast standard is in line with IEC
- SLSI assisting NBSM in Nepal to develop a test electromagnetic ballasts test protocols for labeling.

SLSI Instruments:

- SLSI has a Yokogawa 2533 Digital Power Meter with **0.1%** accuracy for V, A,W and a Model 2524, **0.5%** accuracy; V, A,W, which is 15 years old
- Some V, A,W (power) meters are available that have **0.01%** accuracy
- For ballasts, power consumption is measured but not the distortion, THD. PF measurement is not required but measurements are taken

Integrating Sphere (used for testing GSL lamps)

- Calibration lamps were obtained from NPL in the United Kingdom
- The lumens flux meter is a model PR30101540; brand: Macom Photometrics of Scotland
- Power Supply – DC power would be better to determine lumens flux because it is more accurate. SLSI indicated that there is no change in the value of lumens from using DC instead of AC power
- Equipped with three calibrated standard incandescent lamps. Theses are used to calibrate the other lamps. A record is kept on how many hours each has been used. It is permissible to use these for only a given number of hours before these can no longer be used to calibrate the integrating sphere
- SLSI does not have the equipment to measure the different frequencies needed to determine the color temperature (NERD can measure color)
- Incandescent life-testing requires room temperature control; uses a voltage stabilizer and a strip chart to note the exact time of bulb failing

Quality Control and Calibration

- The Ministry of Trade runs a primary measurement division that has standard mass and length but not electrical quantities
- ITI has electrical measurements but does not have any traceability to a national physical standard. ITI has its instruments calibrated by ETDC in Bangalore, which is under ERTL and gets its instruments calibrated by India's NPL
- The Arthur C. Clark Center is a government organization that has precision instrumentation that can be used for calibration, but it is not traceable to a central standard
- The Arthur C. Clarke Institute for Modern Technologies Established in 1994. Email: info@accmt.ac.lk; telephone: 2650838; Part of the ministry of Science and Technology
- It costs about 10,000 RS to calibrate a Watt meter at the Arthur C. Clark Center

Other and General Observations

- Safety tests can be done by outside laboratories if these laboratories are registered with SLSI and the product retesting can be avoided
- Mandatory safety tests are required for ballasts and fans – need SLS Mark.
- Fan testing is done for safety but not for delivery airflow
- There is no testing and no standard for motors. Could adopt IEC
- There is no test for refrigerators
- SLSI standards are not just only efficiency related but must also pre-qualify by passing the safety tests
- Refrigerator safety and some performance requirements will need to be met to qualify for the energy rating

Status of Labels:

- All labeling programs are voluntary
- CFLs – have been implemented
- Ballasts – implemented and looking at making it compulsory
- Refrigerators – not implemented
- Motors – none
- Fans – Plans to label all fans. A standard is available but it needs to incorporate energy use, which will be revised to conform with the IEC test procedure and requirements

What can SARI/Energy do to help?

Important needs are:

- Proficiency testing
- Traceable calibration
- An accreditation body
- Accreditation and equipment for electrical laboratory

- Support for accreditation costs (e.g., fees for the SEDAC accreditations were 800,000 SL Rupees)

3.2.3 Ceylon Electricity Board (CEB)

The Demand-side Management Branch of the Ceylon Electricity Board (CEB) is interested in labels for several products, such as, lighting, fans, refrigerators, motors, etc.

Refrigerators

- CEB is building a facility to test refrigerators
- The refrigerator test facility project is being funded by the World Bank
- A rough sketch of the layout of the proposed facility was viewed; details of instrumentation, the climate control strategy, or the HVAC system were not apparent from the sketch
- The test facility will be at the CEB "workshop" facility, where cars are repaired.
- CEB estimates about 5 days per test (as per SLS test procedure)
- CEB plans to test two models of three models of refrigerators available, with a test time of 5 days each
- The test facility will be able to test six refrigerators at a time (two models x three samples)
- There are now 120 models of refrigerators sold in Sri Lanka. There are about ten brands, and each importer can handle more than one brand
- The compressor model will be noted on the label
- CEB does not expect all models to be tested at one time. It will cost about 75,000 SL Rupees per model including the volume measurement (only efficiency and safety tests)
- Sri Lanka has special needs, including for example, Sri Lanka has added insulation requirements in order to pass the condensation test. It will also have an ice-making performance test
- There are few problems with forging of labels
- There will be seven classes of refrigerators
- The manufacturers and importers will pay for the testing
- For refrigerators, CEB will accept manufacturers' previously tested results if it is tested to the SLS standards and if they have an accredited laboratory. Manufacturers will pay to test each model it sells in Sri Lanka

Status of the Refrigerator Test Facility Project

Plans are currently under way to build a dedicated refrigerator test facility on CEB property. The status of the three project tasks are outlined below:

- Task 1: preparation for tender of standard for bidding – mail refrigerator standard and tender for the test facility – [completed]
- Task 2: procurement, installation, commissioning, and calibration of the test [in process]

- Task 3: Operation, maintenance manuals, and training

Fans

- Fans are fourth in the CEB list of products to test and label
- A fan label design needs to be established
- A test standard and efficiency levels need to be established
- Currently, a fan advisory committee with 5 or 6 members has been established
- The Indian test procedure does not include noise as a criteria; however, CEB may consider including noise
- SLSI tests fans for safety
- The plan is to locate the fan test laboratory at the University of Moratuwa
- The University has done research on ceiling fans using a hot wire anemometer. The fan research (funded by ECF) was done at the University of Moratuwa

Lighting

Electromagnetic Ballasts

- Electromagnetic ballasts are being tested (at SLSI) but electronic ballasts are not cost effective
- Ballasts – test each model – a nominal fee will be charged as well as a fee for the amount of testing. Surveillance and inspection fee every three years
- SLSI will provide the specifications on how to print the label and the manufacturer or importer will apply the label to the product. The label is printed by the supplier

CFLs

- The quality and expected life of a CFL is a concern of CEB, but rather than require a lifetime test to be conducted to join the CFL rating scheme CEB requires a warranty for the product
- It does not accept the manufacturer's self-tested results. Sri Lanka has a unique test procedure and rating standard, which is basically based on the IEC test procedure
- It will add performance testing next year (in addition to efficacy)

Other and General Observations

- Interest expressed in testing air conditioners

Manufacturers in Sri Lanka

- No refrigerators are manufactured, only assembled, in Sri Lanka. They import the shell and compressor and assemble the refrigerator. (Singer compressors are imported from Malaysia and Singer has its own test facility for R&D.)
- There are no ballast exports
- CFLs are manufactured by five or six manufacturers
- Ceiling fans are made by one manufacturer in Sri Lanka

- All motors are imported (or small domestic pumps)
- Imports include: refrigerators, ballasts, CFLs, and fans

What can SARI/Energy do to help?

- Assistance is needed with the star rating – help is needed with establishing energy efficiency levels
- Assistance is needed on how to measure the refrigerator volume, i.e., the procedure for measuring the useful volume
- Provide information to others on Sri Lankan refrigerator test procedure standard

3.2.4 University of Moratuwa, Center for Energy Studies (CES)

The University of Moratuwa has established a Center for Energy Studies (CES), which is involved in research activities in energy efficiency and environment related to energy. Continuous professional development activities and advisory services in the above areas are also undertaken by CES. It also plays a facilitative role in testing.

The University was not visited but discussions were held with senior staff attached to the centre.

Fans

The University had a fan testing facility five years ago that used SLSI test procedure; it is now dismantled but could easily be set up again. A report on ceiling fans and their service factor has been published. A hot wire anemometer (directional) is used to measure the airflow; however, it also has a vane type as required by the Indian test procedure. Perhaps, some investigation is needed to see which is a better choice or the standard can be written so that, either one can be used if it can give comparable results. The University of Moratuwa estimates the cost of a ceiling fan test facility to be between 0.5 to 0.7 million SL Rupees. This is on the high side and is mostly for instrumentation.

Parameters that might affect the measurement of airflow, such as, the effect of temperature, air density, and altitude, were discussed. It may be useful to further investigate the sensitivity of the above parameters on the test results.

3.2.5 Energy Conservation Fund (ECF)

The Energy Conservation Fund (ECF) is a part of the Ministry of Power and Energy (GOSL) and has the mandate to finance, promote, and initiate activities and projects related to the improvement of any or all energy demand management and conservation programs in Sri Lanka.

The ECF coordinated and partly funded the fluorescent ballast standards and labeling program in May 2000, and it is now taking an active role in developing a standards and labeling program for fans.

Status of Standards and Labeling Programs in Sri Lanka

- Ballasts – magnetic in May 2000
- CFLs – May 2003
- Fans – finalizing the test procedure

Other Information

- ECF is also interested in water pumps but not air conditioners
- Industrial fans are also of interest – axial fans and blowers up to 40,000 cfm used tea drying
- ECF supports regional harmonization
- According to ECF, a regional common label should be a goal but regional accreditation could be a start
- ECF anticipates problems with the refrigerator program due to the importation of used refrigerators to the country
- Policy level people are against mandatory labeling

3.3 Bangladesh

3.3.1 Bangladesh Standards and Testing Institution (BSTI)

The Bangladesh Standards and Testing Institution (BSTI) laboratory was established in 1956 with the initial equipment supplied by the United Kingdom. BSTI is under the Ministry of Industries. A standards and labeling steering committee was convened in Bangladesh eight months ago. The committee expects BSTI to increase testing capability. Another objective stated was to have the Government give incentives to consumers to purchase CFLs. Labeling would be administered by BSTI for mandatory and by others for voluntary labels.

Refrigerators

- There is no testing capability for refrigerators

Ceiling Fans

- Testing is based on the IEC test
- Vane type anemometers used to measure the airflow
- Digital tachometer to measure the rotation speed (rpms) of the fan
- It takes 3-4 hours to run all of the tests on a ceiling fan, including air delivery

Lighting

Ballast Testing

- The Standard is Bangladesh Standard, BDS-816: 1975

- A Fluke 75 is used for measuring voltage; analog meters measure Watts and Amps
- Power Factor for electromechanical ballasts can be measured
- The ballast test procedure used seems to be taken from an old ISO standard that has since been revised
- Ballasts are tested for energy use and Power Factor but not efficiency
- A Voltage stabilizer is used
- Frequency in Bangladesh varies between 49.5 and 51Hz (nominal is 50Hz – a frequency stabilizer is not needed)

Tubular Fluorescent Lamps

- To test a fluorescent tube with a ballast, a Phillips ballast is used a standard ballast
- Tubular lamps are tested for light output, outside of BSTI – at a manufacturer's laboratory
- There are ten places for tubular light life tests

Incandescent Testing

- BDS 17 is like the IEC standard
- Life test of incandescent and tube lights is conducted
- Photosphere is only used for incandescent lamps
- There are 60 places for incandescent (incandescent) lamps – 5 days on and ½ hour off per day
- Photocell for sphere is a spot reflecting galvanometer

Overall Assessment

- Test procedures and equipment need to be updated

Quality Control and Calibration

- Although BSTI has its own calibration laboratory, it was not visited

Other and General Observations

- Bangladesh has a very negative trade balance with India, and it will need to overcome barriers to export to India

What can SARI/Energy do to help?

- Updated (digital) equipment would be useful

3.3.2 Bangladesh University of Engineering and Technology (BUET)

The Bangladesh University of Engineering and Technology (BUET) laboratories are mostly for teaching but are sometimes also used for consulting. The professors conduct testing and the University gets **30%** of the fee. Electrical and Electronic Engineering department had 125 graduates, Computer had 135 graduates, and Civil Engineering had 210 graduates last year.

BUET seems to be able to provide technically trained people for the laboratories. The laboratories are designed more for teaching than for purposes of mass testing. Professors often provide consulting services and testing services at the request of the Government.

Test facilities include a laboratory for testing motors. It has also done some ceiling fan testing but does not have a standard IEC test room or setup. A calibration laboratory is also not available.

BUET has a mechanical teaching laboratory for refrigeration and air conditioning. Designing and testing of air conditioners are done in different laboratories. The University would consider operating a test facility for performance testing if there is a demand. Professors often advise the Government on technical matters. According to the head of Mechanical Engineering Department, if the government wanted testing for labeling, BUET could set up a laboratory.

BUET is only engaged in testing air conditioners for airflow without a calorimeter room and not refrigerators. If there is a demand, BUET would build a laboratory.

The Government gets the University to test pumps, since it has a good pump testing facility. The University has land available to construct additional testing facilities.

3.3.3 Ministry of Power, Energy and Mineral Resources, Power Division – Bangladesh

The Power Division, Ministry of Power, Energy and Mineral Resources (MPMR) constituted a National Steering Committee with the responsibility of setting energy efficiency standards and labeling requirement for end-use electrical appliances.

MPMR reports that:

- Bangladesh has minimum testing
- BSTI has a certification mark (the mark is mandatory for certain items, such as ceiling fan regulators)
- Bangladesh University has certain test facilities
- There are no private test facilities for testing of electrical appliances
- Items manufactured in Bangladesh include: ballasts, fans, lamps, CFLs (assembled), transformers, energy meters, and motors to 50kW
- Bangladesh assembles but do not build refrigerators and air conditioners
- Currently there is no energy label, and there is no accreditation body
- BSTI gives certifications to products
- European refrigerators are assembled in Bangladesh

- Refrigerators are imported from India, Korea, China, Malaysia, and some from Thailand. (Brands include: Whirlpool, Sanyo, Haier, and Samsung)
- The steering committee would like to create the equivalent of India's BEE in Bangladesh to promote EE programs

3.4 Nepal

3.4.1 Nepal Bureau of Standards and Metrology (NBSM)

The Nepal Bureau of Standards and Metrology (NBSM) is the National Standards Body of Nepal. It is one of the departments under His Majesty's Government of Nepal, Ministry of Industry, Commerce and Supplies. NBSM licenses the Nepal Quality Certification Mark or NS Mark to indicate a product meets the quality of a third party. To encourage competent private-sector laboratories and to monitor these laboratories, a laboratory accreditation scheme called Nepal Laboratory Accreditation Scheme (NEPLAS) is already in progress. Five laboratories have already been accredited and more laboratories are in line for accreditation.[2]

NBSM electric and electronics laboratory currently tests:

- Cables
- Dry cell batteries; and
- Switches and sockets (manufactured in Nepal)

Lamp tests were done previously but the factory no longer operates.

Testing is done to Nepal Standards developed at NBSM. These standards are based on ISO and IEC standards. NBSM is a corresponding (non-voting) member of ISO and so can adopt ISO standards. Nepal adapts these standards to Nepal's needs. NBSM has a copy of the ISO/IEC standards, but in the past two years have had a hard time getting the BIS test procedures standards.

Before NBSM starts a new testing laboratory, it should consider the whole process, i.e., the entire requirements from calibration on down. The idea is that if it needs instruments to run a test, it would also want to have the calibration equipment to calibrate those instruments.

Standards at NBSM

There are currently eight mandatory standards at NBSM. These include, for example certification for cement, dry cell batteries, and carpets. Other standards are voluntary. It has the authority to make health and safety standards mandatory. In the part of the test laboratory that was observed, most of the testing was geared towards either passing or not passing a safety or longevity test, especially for cables, tensile tests, insulation tests, etc.

[2] Information from "Nepal Bureau of Standards & Metrology – An Introduction

NBSM believes that manufacturers would participate in voluntary standards.

- NBSM has 700 standards
- 32 of the 700 hundred standards are available for certification
- 8 of these are for mandatory certification

Laboratory Information

The laboratory has a Multimeter Calibrator by a FLUKE, which is now not functioning. Previously, it had also been calibrated five times by ERTL(N). India does not have a facility to repair this instrument, which is used to calibrate other multi-meters. A new calibrator of this type was estimated 10 years ago to cost approximately 1.3 million NRs (about US$ 18,000). NBSM requires this to calibrate the other instruments.

The tour of the Electrical Testing Laboratory revealed the following information:

- A Tektronix oscilloscope is available
- The voltage fluctuates from 190v to 250volts
- The frequency is 48-50Hz (50hz nominal)
- A Fluke 5100B calibrator, last repaired and calibrated in 1998; range is 0-1000 volts AC or DC; current 2 amps max, resistance to 10Mohm
- The equipment is not temperature controlled
- Equipment in room is mostly for IEC safety tests
- The Electrical and Electronics laboratory consists of two rooms
- For the Fluke calibrator, an amplifier is used to boost the 2 ampere output to 20 amperes. The equipment: Fluke 5220A, transconductance Amplifier; it has a voltage output and a current output

Refrigerators

Nepal does not have a refrigerator test facility. Refrigerators are not manufactured in Nepal but LG refrigerators are assembled and branded in Nepal (There are many brands).

Lighting

The photometric sphere was bought from a company in Bangalore – Interior needs painting and it no longer has a photometer to measure lumens. NBSM has standard lamps calibrated from India. It has a standard for incandescent light bulbs. The approach to testing, it seems, is that there should first be a demand from the industry for the standards (i.e., manufacturers in Nepal).

Ballasts

There are two ballast brands assembled in Nepal. NBSM would set up a ballast testing laboratory if financial support is available either from USAID or any other donor to commence a labeling program. Without outside funds, it will not be possible to obtain funds from the Government. If equipment to test one product is available, then it was reported to us that it would be easier to convince the Government to fund other test facilities/equipment for other products.

Quality Control, Calibration and Metrology Laboratory

NBSM sets the basic standards for Nepal, including mass, pressure, and density. NBSM is part of the APP metrology program and the Organization of League of Legal Metrology. (This temperature controlled room was not a part of the visit.)

General Comments:

- Initially, only voluntary standards would work
- NBSM states that harmonizing test procedures is no problem, but it takes too much time. To be effective, the test procedures need to be harmonized with all of the countries
- The total staff is 110 (about 50 are technical) and the Electrical and Electronics laboratory has four people
- Technical staff have been trained or educated at the Electronics Laboratory at the Institute of Engineering (IOE). Some have also received training scholarships from foreign universities
- Corruption (forged labels) can be an issue with standards and labeling programs in Nepal

What can SARI/Energy do to help?

NBSM needs funds to build testing laboratories and an equipment calibration facility.

4.1 Introduction

The ultimate purpose of visiting testing facilities is to see whether regional facilities can support the overall goals of a standards and labeling programs in each country. This raises various questions, including whether each country needs, or wants, its own testing facilities or if it would accept outside test results. If a decision is made to harmonize test results among countries, what is required to assure uniformity and trust in each other's test results? Therefore, a process must be worked out to ensure trust and uniformity in testing.

To harmonize labels or minimum efficiency standards, products will need to be tested to a common test procedure. It may also be desirable for facilitating trade and simplifying testing, to have the testing done in one country be accepted by another country. Thus, this report also examines the accreditation protocols in each country. One way to ensure confidence in testing and calibration laboratories is to have these facilities accredited.

Not all countries have their own accreditation bodies. One scenario would be to have, for example, Sri Lanka, apply for and receive accreditation by a foreign accreditation body. This process is common, but the cost of accreditation can be substantial, although the charges vary with each accreditation body. Some organizations, such as NABL in India, are much lower in cost then others, outside South Asia.

4.2 Agreements Among Countries — Harmonization, MRAs, MOUs, and Membership in Umbrella Organizations

To allow products to be tested in laboratories in the different SARI/Energy countries, each country could establish its own accreditation body, complying with ISO 58, and apply to have the accreditation body accepted by the International Laboratory Accreditation Cooperation (ILAC) and the Asian Pacific Laboratory Accreditation Co-operation (APLAC). For this, no other MRAs should be necessary if the countries were signatories to ILAC and APLAC. A laboratory can be assessed by any ILAC body from any country.

Another approach would be to have a bilateral agreement with another country and have a Government-to-Government MRA or MOU.

4.3 Which Laboratories Need Accreditation?

A country may require that all submitted test results be tested by an independent test laboratory. Alternately, manufacturers could submit test results without being accredited, with penalties if they misrepresent non-complying products as complying.

A country can certify that products tested by an independent laboratory outside the country have the same status as those tested by an in-country independent laboratory.

However, for dispute resolution only designated laboratories within the country can be used. A regulatory body, as part of a check testing program is unlikely to witness a test outside its own country; therefore, for this purpose, an in-country test facility would have an advantage.

4.4 Accreditation Requirements for Labeling in Other Countries

USA
The U.S Department of Energy does not required products to be tested in an accredited laboratory except for lighting and motors. For other products, the manufacturers or a manufacturers' trade association report product efficiencies directly to the Department of Energy and the Federal Trade Commission for compliance.

Canada
Testing for efficiency certification must be performed by a third-party laboratory that is an accredited certification body. This laboratory must by law be accredited by the Standards Council of Canada (SCC).

Australia (Victoria)
A request for proposal is sent out, which is typically bid on by four or five test laboratories. The laboratories must meet certification requirements.

Europe
Within the European Union there are designated laboratories that are certified to resolve test disputes on a product-by-product basis. Data is self-reported by the manufacturers. European Union recognizes several test facilities for every product to arbitrate disputes on reported efficiencies.

Philippines
All model numbers must be tested by a government test facility. The Philippines started by testing every model of air conditioner.

Mexico
In Mexico every room air conditioner must be tested by a test facility in Mexico.

China
Testing for minimum energy performance standards (MEPS) are done once when a new model is introduced. All models from manufacturers must be tested to accord with the minimum standard. This is done by taking multiple samples of a particular model from the production line and sending them to a certified government testing lab. However, there are no explicit enforcement mechanisms beyond this if the manufacturer then decides to cheat. There are no third-party non-governmental testing laboratories or self-reporting from manufacturer test laboratories — only the certified national laboratories. (This may eventually change with WTO; the UL has moved aggressively into China, but so far it does only safety tests). The lack of funds to do this is a problem. The national test laboratory also sells its laboratory testing services to the manufacturers. This creates a financial dependence on the same manufacturers that it is required to regulate.

4.5 Accreditation versus Recognition

The countries visited have government standards institutions that are responsible for setting standards for safety, efficiency, product labeling, performance, and construction. This also means India, Bangladesh, Sri Lanka, and Nepal have a standard mark. This is often one source of revenue generated by a standardization body. For example, in India, the IS Mark signifies that a product meets all of the test and performance criteria specified in the Indian Standards (IS) used in the BIS Laboratory Recognition Scheme. The BIS also recognizes other test laboratories that do the testing required to ascertain if a product meets the IS Mark minimum standards. In this case, it would be said that a laboratory is recognized by BIS, which is not the same as being accredited by an accreditation body. Recognized laboratories may or may not be accredited (see discussion of NABL below).

4.6 Role of Consumer Organizations

Of the countries of interest, only India has consumer organizations that test appliances. In fact, India has two prominent consumer organizations that test consumer products and publish magazines with the results. One organization, CERC has its own laboratories, while the other VOICE, contracts out testing. These consumer organizations sometimes test products that have received certification for the IS Mark by BIS but do not always get the same results. In fact, some tests reported in the past show that some products labeled with the IS Mark do not meet the minimum required energy or other performance requirement. .

4.7 National Primary (Physical) Standards Laboratory

One primary requirement of achieving accreditation is to have instruments calibrated. Often, specifications say instruments need to be calibrated with traceability to a national primary standard. India has such a laboratory, the National Physical Laboratory (NPL). Other countries do not have such laboratories or are limited to physical non-electrical measurements.

4.8 The Role of International Laboratory Accreditation Cooperation (ILAC)

ILAC defines accreditation as:

> "Laboratory Accreditation provides a means of determining the competence of laboratories to perform specific types of testing, measurement and calibration. It enables people who want a product, material or instrument to be checked or calibrated to find a reliable testing or calibration service able to meet their needs. It also allows a laboratory to determine whether it is performing its work correctly and to appropriate standards. Manufacturing organizations may also use laboratory accreditation to ensure the testing of their products by their own in-house laboratories is being done correctly."

ILAC defines its role as:

> "ILAC is an international cooperation between the various laboratory accreditation schemes operated throughout the world. Founded twenty years ago, ILAC was formalized as a cooperation in 1996 when 44 national bodies signed a Memorandum of Understanding (MOU) in Amsterdam. This MOU provides the basis for the further development of the Cooperation and the eventual establishment of a multilateral recognition agreement between ILAC member bodies. Such an agreement will further enhance and facilitate the international acceptance of test data, and the elimination of technical barriers to trade as recommended and to support the World Trade Organization (WTO) TBT agreement.
>
> As part of its global approach, ILAC also provides advice and assistance to countries that are in the process of developing their own laboratory accreditation systems. These developing systems are able to participate in ILAC as associate members, and access the resources of ILAC's more established members.
>
> In conjunction with ILAC, specific regions have also established their own accreditation co-operations, notably in Europe (EA) and the Asia-Pacific (APLAC). These regional co-operations work in harmony with ILAC and are represented on ILAC's board of management. ILAC is encouraging the development of such regional co-operations in other parts of the globe.
>
> Hence, ILAC is the world's principal international forum for the development of laboratory accreditation practices and procedures, the promotion of laboratory accreditation as a trade facilitation tool, the assistance of developing accreditation systems, and the recognition of competent test facilities around the globe."

According to NABL, since January 2000, if a country is an APLAC signatory, then it is also an ILAC signatory.

4.9 India — Accreditation

4.9.1 National Accreditation Board for Testing and Calibration (NABL)

India has an accreditation body called the National Accreditation Board for Testing and Calibration (NABL), which is a signatory to the larger umbrella organizations for the accrediting bodies of ILAC and APLAC. For an accreditation body to become a member of ILAC or APLAC, the accrediting body needs to document that it meets all the ILAC and APLAC requirements. NABL meets the accreditation requirements of these organizations. Therefore, a laboratory accredited by NABL should be accepted by any other organization as a laboratory accredited by ILAC or APLAC. Additional information is available at the NABL web site:
http://www.nabl-india.org/

NABL has been a *member* of APLAC since 1999. Membership allows them to participate in technical committee meetings but does not have the same status as a signatory. NABL has been a *signatory* of APLAC since January 2001. This means if an NABL accredited laboratory has tested something, it does not need to be retested by APLAC rules.

NABL follows ISO Guide 58 – *Calibration and testing laboratory accreditation systems – General requirements for operation and recognition,* which defines the accrediting body. Its corrective action is per ISO/IEC Guide 43-1:1997 *Proficiency testing by interlaboratory comparisons -- Part 1: Development and operation of proficiency testing schemes,* and ISO Guide 43 -ISO/IEC Guide 43-2:1997 *Proficiency testing by interlaboratory comparisons -- Part 2: Selection and use of proficiency testing schemes by laboratory accreditation bodies.*. The laboratories seeking accreditation from NABL must follow ISO 17025 – *General requirements for the competence of testing and calibration laboratories*.

After a laboratory applies for accreditation, an assessor (typically a consultant) visits the test laboratory. The laboratory must put together a quality manual and a procedures manual as per ISO 17025. ISO 17025 is by its nature general, and, therefore, laboratories have to specify in greater detail how they will achieve the desired quality in testing.

As part of the accreditation process for a specific test, the applying laboratory needs to participate in a proficiency interlaboratory comparison test, whereby, the results from testing is compared to the results obtained by other laboratories.

A benefit of SARI/Energy countries using NABL as their accrediting body would be that it is less expensive to become accredited by NABL than by an European or US accreditation agency. The process of becoming accredited by NABL is illustrated in Figure 2.

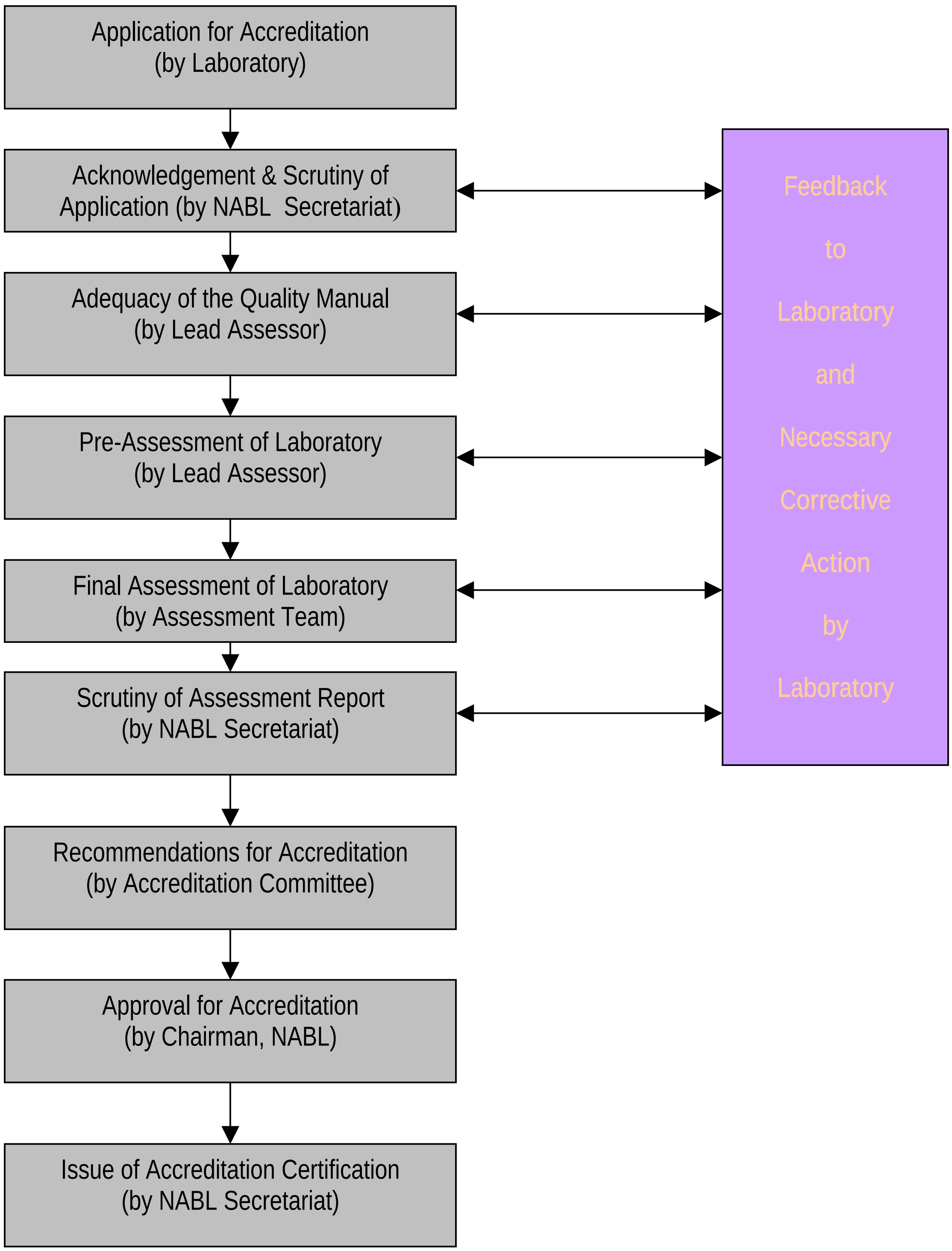


Figure 4.1: NABL Accreditation Procedure

4.9.2 Training Auditors / Assessors

NABL uses ISO Guide 51 to train auditors. The auditor training center is in Jaipur. To become an auditor, the person should be actively working in a laboratory. To avoid a conflict of interest, auditors cannot assess the laboratories in which they work, nor can they assess laboratories under the same ministry. The training course takes 5 days and concludes with a test the candidates need to pass. Foreigners can become auditors by: sending a biography, taking the exam and passing it, and actively working in a laboratory.

4.9.3 Time and Cost to Become an Accredited Test Facility

It costs IRs. 10000 (about US$ 222) to apply for an accreditation application (see p. 20 of the NABL General Informational Brochure, June 2003). The cost of accreditation and time to achieve accreditation is available in the NABL informational brochures. More information on NABL is available on their web site: http://www.nabl-india.org/ .

4.9.4 NABL Training

NABL does not provide technical training on how to run a test, but it does have training available for putting together a quality manual to meet ISO 17025. Some laboratories in the past have been accredited to ISO Guide 25. The international deadline to convert to ISO standard 17025 was December 2002. For NABL accreditation, the deadline was extended to March 2003.

4.9.5 NABL Applicability to Other Countries

Laboratories outside of India can also be accredited by NABL, and several organizations in Bangladesh have been accredited by NABL. However, Nepal and Sri Lanka have not applied for applications to become accredited by NABL.

4.9.6 Accreditation of Refrigerator Test Laboratories in India

In India, the Bureau of Energy Efficiency will require independent test laboratories to be accredited before they can be used in any enforcement program using check testing and challenge testing. Manufacturer laboratories are strongly encouraged to become accredited, although the regulations do not require accreditation as a condition of testing and reporting energy efficiency data. Laboratories seeking accreditation will be required to demonstrate that they can conduct a refrigerator test as per the required test procedure.

At the time this report was being written, an interlaboratory testing proficiency test was being planned for both independent and manufacturers' refrigerator test facilities. ERTL(N) a government affiliated testing facility (see Section 3.1.3 of this report) was chosen, based on their record, to be the coordinating laboratory for refrigerator proficiency testing. Eight laboratories will participate in the round-robin proficiency test. The assessment to become accredited includes a witness test in which each test procedure must be demonstrated. ERTL(N) will do the first test and will retest after every second laboratory to see if there were any changes to the refrigerator test values due to transport. Power consumption and volume will be determined. A report will be presented to the team members who will either pass or fail based on the comparison to the reference laboratory. If a result is noncompliance, the proficiency testing can be performed again . If a laboratory fails the test, they can try again in the next round of proficiency testing. If there is a system failure after the laboratory has been accredited, then ways for improvement are presented and the laboratory will be under surveillance for three months. In the past, Government laboratories as well as manufacturer laboratories have sought NABL accreditation for other products.

As of July 2003, NABL was still looking for assessors qualified to evaluate refrigerator test facilities. NABL chooses assessors based on their experience for testing a product. In this case, it may be manufacturers or an independent test laboratory. If necessary, finding an assessor who does not have a conflict of interest in accrediting a laboratory (e.g., assessing a competitor, competing laboratory, or competing manufacturer) will be a difficult task.

4.10 Sri Lanka — Accreditation

Sri Lanka does not currently have an independent accreditation body that is part of a larger regional or international accreditation body system. Several institutions were visited and were asked about the present and future status of accreditation in Sri Lanka.

4.10.1 NERD Centre — A Testing Facility

NERD has not investigated the costs of becoming accredited by an accrediting body belonging to APLAC or ILAC. However, the World Bank says that the PV Systems (that NERD currently tests) have to be tested under a laboratory accredited to ISO 17025. NERD is seeking this accreditation. NERD has also sought help from BIS on getting this certification. BIS has contacted Geneva (IEC) in this regard. IECQ covers quality standards on electronic components. Lamps may not be covered under the same scheme as PV systems. ETDC Bangalore (a laboratory under ERTL(S) India) provided assistance on how to get accreditation. However, NRED did not apply for accreditation from NABL, India's accreditation body. No mutual recognition agreements have to this point been established with NERD for the transferability of test results. In response to a question on the topic of accreditation, NERD suggests that if a laboratory is accredited, no MRA would be necessary.

Sri Lanka has a national weights and measures (physical) standards department under the Ministry of Trade that is the legal entity for weights and measure. However, it is not set up to do electrical measurements or calibrations. A national calibrating authority that includes electrical measurements is needed in Sri Lanka, according to the Director of NERD. This would be akin to the US NIST or India's NPL and would allow all calibration to be traced back to one national standard.

4.10.2 SLSI — Sri Lanka Standards Institute

The Sri Lanka Standards Institute (SLSI) believes that Sri Lanka should have its own accreditation body. However, SLSI is willing to accept results from other regional accredited laboratories. An establishment of an official accreditation body has been proposed but yet to be voted into existence by Parliament. A National Laboratory Accreditation Committee has been established and consists of 13 scientists and other stakeholders who plan to expedite the process for creating a separate agency for accreditation. The accreditation body is expected to be under the same ministry as SLSI, Ministry of Science and Technology, yet separate from SLSI. The process of establishing an independent national accrediting body has been in the process for the last three years.

Until an independent accreditation body is established, SLSI will administer the Accreditation Services for Testing Laboratories (ASTEL) scheme, which in the absence of an accreditation body follows the ISO 17025 rules. ASTEL can "accredit" outside laboratories but not themselves. Ten laboratories are now accredited by ASTEL (operated by a separate body outside of SLSI).

SLSI has a common quality manual for the whole laboratory, and it is based on ISO 17025. They have a Quality System Document and a Quality Manual. In addition to the overall ISO 17025 compliant manual, they have department specific manuals for more specific procedures.

The Chemical and Microbiology Departments have been accredited for certain tests by SWEDAC, the Swedish accreditation body. This was achieved with UNIDO funds and UNIDO requested the SWEDAC accreditation. SLSI believes that, until Sri Lanka has its own accreditation body approved, using NABL accreditation would suffice. The fee for the SWEDAC accreditations was 800,000 SR Rupees. There were also additional costs to participate in a proficiency test (i.e., to test a sample).

The India Institute of Quality Management has been a consultant to SLSI and has conducted a training program for accreditation.

4.10.3 Certification

SLSI has an MOU with India (BIS) on product certification so that BIS can give the SLS Mark for products manufactured in India. BIS will do the surveillance and has the product tested in India. Similarly, SLSI can test products to meet the BIS Certification Mark.

4.10.4 Primary Weights and Measures

The Ministry of Trade runs a primary measurement division that has standard mass and length but not electrical quantities. ITI, a Sri Lankan calibration laboratory, has electrical measurements but does not have any traceability to a national physical standard. ITI has its instruments calibrated by ETDC in Bangalore, under ERTL, which gets its instruments calibrated by NPL. Although SLSI has its own metrology laboratory – it is not traceable to a national metrology laboratory, i.e., it is not traceable to international metrology standards.

4.10.5 What can SARI/Energy do to help?

When asked what SARI/Energy can do to help in implement testing or standard setting and labeling, SLSI responded with the list of items below:

- Proficiency testing would be useful
- Traceable calibration to overcome problems associated with transporting equipment. A power meter sent to EDTC in India for calibration came back broken due to damage in transport
- Sri Lanka wants to establish its own accreditation body

4.10.6 CEB Regarding Transferability of Test Results Among Countries

CEB would accept the test results from other countries, but it does not think manufacturers selling in Sri Lanka would go to another country for testing because the cost would be higher than at NERD, for example.

4.10.7 ECF – Energy Conservation Fund

ECF believes that a regional common label should be a goal and accreditation could be a starting point. The process could be initiated by harmonizing BIS with SLSI. This has been done in the past through SAARC.

4.11 Bangladesh – Accreditation

Bangladesh does not have an accreditation body. There is currently draft legislation that would establish an accreditation body in Bangladesh. The draft Bangladesh Accreditation Board Act has not yet approved by the Parliament. However, it is likely to be passed in 2003.

4.11.1 Accreditation and Agreements with Other Countries or Regional Entities

BSTI provided an insight into the possibilities of having a Bangladesh test facility accredited by NABL of India. For this, test results should be valid across borders.

Although BSTI could get accreditation from NABL of India, it would be preferable to be accredited by a European Union accreditation body. It suggests that an NABL accreditation may not be accepted in Europe. It believes that even if BSTI were accredited by NABL, which is an ILAC signatory, Bangladesh would still need to have a MOU with India. Even if BSTI was accredited by a recognized accreditation body, BSTI would still need to have a MOU with each country or with the European Union (EU) and get 26 countries at once. Bangladesh's primary export market is Europe.

4.12 Nepal — Accreditation

NBSM (Nepal Bureau of Standards and Metrology) provided the following insights.

4.12.1 Accreditation

The organization chart for NBSM shows that accreditation is an arm under the Director of the Laboratory. Currently, it has its own accreditation for its chemical laboratory. When asked if accrediting themselves wasn't a conflict of interest, NBSM responded by indicating that it is entirely a different branch of NBSM so there is no conflict of interest. NBSM started this accreditation scheme — Nepal Laboratory Accreditation Scheme (NLAS) — was introduced two years ago.[3] The scheme follows ISO 17025 and up to this time, five chemical laboratories have been accredited. It is also trying to get APLAC accreditation for some chemical laboratories or perhaps a laboratory accredited by APLAC. NBSM sent two samples of chemicals for an interlaboratory comparison test with HOKLAS, the Hong Kong standards laboratory and passed the test.

Regarding the option of having NBSM laboratory accredited by NABL, they would rather have their own calibration and accreditation body. The accreditation would follow the ISO standards for setting up an accreditation body, i.e., *Guide 58, Calibration and testing laboratory accreditation systems – General requirements for operation and recognition*. Discussions have taken place with NABL to harmonize accreditation with them. There is a perceived high cost to join APLAC.

NBSM also plans to get ISO 9000 accreditation. It has been reviewed by BIS for this purpose and needs to get BIS training for accreditors. NBSM says that ISO 9000 requires an organization have at least 20 staff members accredited as assessors. Sixteen people have already been trained.

4.12.2 Primary Physical Standards Laboratory

NBSM has visited and the equipment calibrated by NPL.

4.12.3 Certification

NBSM has contacted the BIS to establish an MOU with BIS and it does not have a problem with adopting the test procedures from another country, but for product standards, NBSM would like to set those to its own situation.

[3] Would ILAC or APLAC agree that having the accrediting agency under the same direction as the laboratories seeking accreditation is separated enough to avoid a conflict of interest?

In this section findings are summarized by product.

5.1 Refrigerators

Refrigerator testing is a priority for India. Current activities include harmonization of test procedures with Sri Lanka and decisions on how the volume should be measured. A round-robin test among laboratories in India has also been initiated.

5.1.1 India

The team did not see any laboratories that had actually run a verified test on a refrigerator. The following laboratories expressed intentions to run refrigerator tests:

- ERTL(N) needs training, needs to set up data acquisition, and needs to modify the test chamber
- ERDA is planning on building a new test facility (the plans seem good)
- CERC has a test facility but needs modification. Training is also needed
- CPRI has environmental chambers not designed for refrigerator testing; it needs modification and data acquisition is not set up. It will build a dedicated facility for testing refrigerators if there is enough demand to be financially feasible
- IIT (Delhi) has tested refrigerators but the facility needs upgrading. If funds become available, this test facility will be improved

5.1.2 Sri Lanka

- CEB is building a test facility – the plans are not far enough along to evaluate

5.1.3 Bangladesh

- It does not have any refrigerator test facilities

5.1.4 Nepal

- It does not have any refrigerator test facilities

5.2 Fans

All facilities would benefit from a round-robin test. There are small differences in the method used to execute the test among the various facilities. It would be useful to investigate the major sources of error.

5.2.1 India

- BIS has facilities
- ERDA can set up a test facility quickly – it is looking for funding if possible
- RTC has facilities
- CERC has good automated facilities
- CPRI has good facilities

5.2.2 Bangladesh

- BSTI has a ceiling fan testing facility that can measure air delivery

5.2.3 Sri Lanka

- Currently, there is no fan testing facility that can measure air delivery
- Sri Lanka has plans to build such a facility. Who and where the testing will take place has yet to be decided

5.2.4 Nepal

- It does not have a fan testing facility

5.3 Lighting

5.3.1 India

- BIS has some facilities for testing for tubular fluorescent lamps and inductive ballasts
- ERTL(N) has a facility for testing CFLs and tubular fluorescent lamps except for color measurement
- RTC(NR) has a facility for testing inductive ballasts. It has a plan to complete the facility for testing CFL lamps (funds will not be a problem)
- ERDA has facility for testing all types of lamps, including CFLs and tubular fluorescent lamps and ballasts including inductive and electronic
- CERC has a facility for testing all types of lamps, including CFLs and tubular fluorescent lamps including inductive ballasts. (CERC is studying whether all the tests as per IS and IEC can be done on Electronic Ballasts.)
- CPRI has facility for testing all types of lamps, including CFLs and tubular fluorescent lamps and ballasts including inductive and electronic

5.3.2 Sri Lanka

- NERD has good test facilities to test CFLs and if needed could test other lighting as well

- SLSI uses a simplified method to test magnetic ballasts that does not require reference ballasts. Reference ballast is required to perform test according to IEC international test procedures. Electronic ballast testing is not performed

5.3.3 Bangladesh

- BSTI has basic equipment for testing GSLs. Two of the three meters are analog
- It does not have reference ballasts needed to test to IEC international test procedures

5.3.4 Nepal

- Does not have any test facilities to test ballasts or lamps to international standards
- May use a simplified method to test ballasts via a method not requiring reference ballasts or lumen output as demonstrated by Sri Lanka
- Existing GSL lamp (incandescent light bulb) test facility is in disrepair and would need funds to make functional

5.4 Motors

5.4.1 India

- BIS, ERDA, CERC, and CPRI have facilities to test motors
- Measuring instruments at BIS are mostly analogue type and need upgrading to digital type
- RTC has some facility for testing electric motors
- ERTL(N) does not have motor testing facility

5.4.2 Sri Lanka

- Sri Lanka does not have motor testing facilities.

5.4.3 Bangladesh

- Bangladesh does not have motor testing facilities

5.4.4 Nepal

- Nepal does not have motor testing facilities

5.5 Recommendations on Accreditation

Accreditation of laboratories is an important element ensuring validity and promoting acceptance of test data, thereby facilitating trade and commerce. In India, the NABL has been established in accordance with ISO/IEC Guide 58. NABL provides laboratory accreditation services to laboratories in India and abroad that are performing tests/calibrations in accordance with ISO/IEC 17025. NABL is a full member of ILAC and APLAC, and it is also signatory to the MRA under ILAC and APLAC, which is based on mutual evaluation and acceptance of test /calibration results among countries that MRA partners represent.

The fee structure of NABL has been revised and the following will be applicable from October 1, 2003:

1. Application fee Rs. 10 000/field
2. Assessment fee: Actual expenditure comprising traveling, boarding, and lodging, and honorarium to the assessor(s) – once to the lead assessor for pre-assessment and another to the assessment team (comprising one or more assessors) for Final-assessment
3. Overhead charges: Rs. 5 000
4. Accreditation fee: Rs. 10 000/field/year

Validity of accreditation is for three years, and the laboratory can apply for renewal for which re-assessment is done.

It may be time-consuming and economically not feasible to establish a body similar to NABL India in other South Asian countries. Also, establishing accreditation of laboratories in Bangladesh, Sri Lanka, and Nepal with accreditation bodies in European or other South Asian countries will be far costlier as compared with NABL India. It is recommended that these laboratories seek accreditation with NABL India.

Although, in general, those countries not having an internationally recognized accreditation scheme wanted to establish their own accreditation body, pending the establishment of accreditation bodies in SARI/Energy countries. Because the cost of accreditation from NABL is lower than its European and US counterparts, NABL is a logical choice for regional accreditation.

It is also recommended that until conditions warrant or funds are available (or if economically feasible), countries share available regional test laboratories.. Most countries seem to be strongly interested in having in-country test facilities for products that they manufacturer in the country.

Another consideration is the cost of test facilities and the number of appliances that are tested. For example, it may be more cost effective to have a regional laboratory test a refrigerator than to build a test facility.

Another consideration is the requirements for exporting a product and whether the regional test facility is equipped to test to the country to which the product would be exported.

Figure 5.1 illustrates a proposed process for test facility accreditation in the SARI/Energy countries.

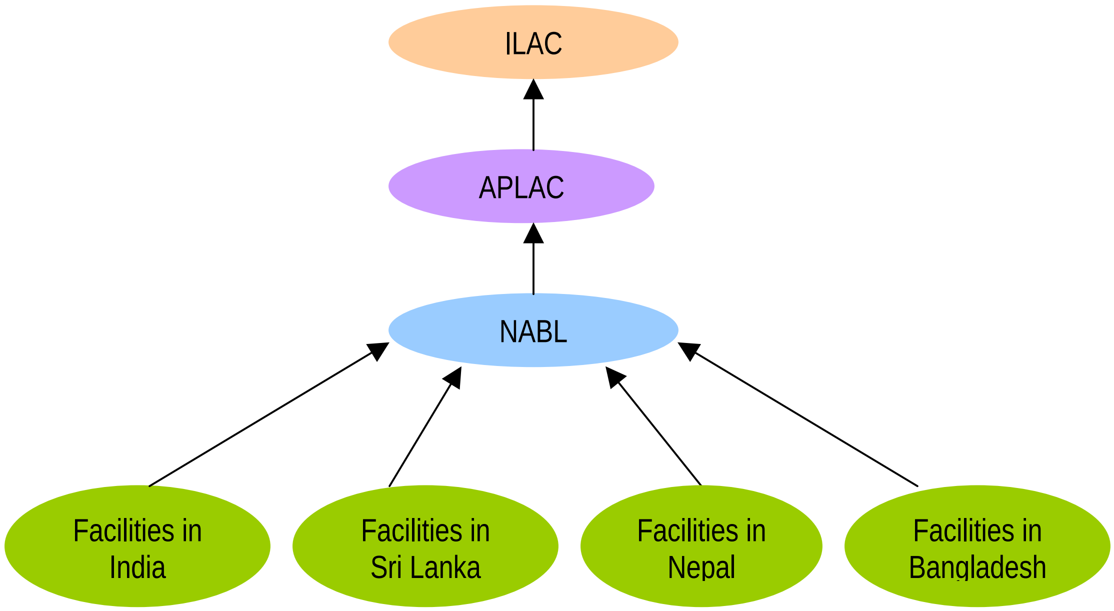


Figure 5.1: Proposed Test Facility Accreditation for SARI/Energy

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ILAC
http://www.ilac.org/

APLAC
http://www.aplac.org/

NABL
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CLASP – Collaborative Labeling and Appliance Standards Program
www.clasponline.org

BEE – motors
http://www.bee-india.com/monitoring/standards_motors.html

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http://www.naresa.ac.lk/slsi/profile.htm#news

INDIA

NABL — National Accreditation Board for Testing and Calibration Laboratories

Dr. Rubeena Saleem
M.Sc.Ph.D.
Accreditation Officer
National Accreditation Board for
Testing & Calibration Laboratories
Department of Sciences & Technology
B-4/B-6, Qutab Hotel,
New Mehrauli Road
New Delhi-110 016, India
Tel: 91-11-6529718/19/20, ext. 22
Fax: 91-11-6529716
rsn@nabl-india.org
www.nabl-india.org

Dr. A.K. Chakrabarty
Ph.D. (London, D.I.C., B. Tech.)
(IIT-Kharagpur) Adviser, DST & Director, NABL
National Accreditation Board for
Testing & Calibration Laboratories
Department of Sciences & Technology
B-4/B-6, Qutab Hotel,
New Mehrauli Road
New Delhi-110 016, India
Tel: 91-11-26529718/19/20, 26526890(D)
26493217(R)
Fax: 91-11-26529716
akc@nabl-india.org
akc@alpha.nic.in
www.nabl-india.org

BIS — Bureau of Indian Standards

Jagdish Chandra
Scientist E & Head (Electrotechnical),
Director
Bureau of Indian Standards
Manak Bhavan
9 Bahadur Shah-Zafar Marg
New Delhi 110002, India
Tel: 91-11-23231192
Fax: 91-11-23221535
etbis@vsnl.com

P.K. Mukherjee
Scientist E (Director)
Electrotechnical Department
Bureau of Indian Standards
Manak Bhavan
9 Bahadur Shah-Zafar Marg
New Delhi 110002, India
Tel: 91-11-23233375, Ext. 4271
Fax: 91-11-23239399
etbis@del2.vsnl.net.in

K.M. Hatia
Dy. Director General (Lab.)
Bureau of Indian Standards
Central Laboratory
Plot No. 20/9, Site-IV
Sahibabad Industrial Area
Sahibabad (U.P.) 201010
Tel:91-120-4770219
Fax: 91-120-4776663
bis_cl@satyam.netin

ETRL(N) — Electronics Regional Test Laboratory (North)

Sunita Binji
Scientist 'C'
STQC Directorate
Ministry of Communications & Information Technology
Department of Information Technology
Govt., of India
S-Block, Okhla Industrial Area
Phase-II
New Delhi-110020, India

Tel:91-11-6385976, 6384400, 6386143, 6386118,
6386498, 6386238
Fax: 91-11-6384583, 6910974
ertln@ernet.in

Surjit Singh
Scientist ‘F’
Electronics Regional Test Laboratory
(North)
STQC Directorate
Ministry of Communications & Information Technology
Department of Information Technology
Govt., of India
S-Block, Okhla Industrial Area
Phase-II
New Delhi-110020, India
Tel: 91-11-26385976, 26384400, 26386153,
26386118, 26386238
Fax: 91-11-26384583, 2610974
ertln@ernet.in

Gurmukh Singh
Additional Director
Govt. of India
Ministry of comm.. Information Technology
STQC Directorate
Electronics Regional Test Laboratory (North)
S-Block, Okhla Industrial Area, Phase-II
New Delhi 110020, India
Tel: 91-11-6386204 (direct)
6384400, 6386143, 6386118, ext 28
Fax: 91-11-6384583
ertln@ernet.in

RTC — Regional Testing Centre

A.K. Gogia
Director
Regional Testing Centre (NR)
Ministry of SSI, Govt. of India
Shahid Capt. Gaur Marg
Okhla, New Delhi-110020, India
Tel:91-11-26314616
Fax: 26847973

S.M. Jamkhandi
Deputy Director (Electrical)
smjamkhandi@hotmail.com
Off: rtcnr@nde.vsnl.net.in

ERDA — Electrical Research & Development Association

Dr. M. Ramamoorty
Director
Electrical Research & Development Association
ERDA Road, G.I.D.C.
Makarpura, Vadodara, 390010
Tel: 91-265-638633 (Direct)
EPABX: 91-265.642942, 642377, 642557, 642964
Fax: 91-0265-638382
erda@wilnetonline.net

A.K. Singh
Additional Director
Electrical Research & Development Association
ERDA Road, G.I.D.C.
Makarpura, Vadodara, 390010
Tel: 91-265-2647163 (Direct)
EPABX: 91-265-2642942, 2642377, 2642557, 2642964
erda@wilnetonline.net

Dr. Vagish Shrinet
Head, Technology Development & Commercialisation Centre
Electrical Research & Development Association
ERDA Road, G.I.D.C.
Makarpura, Vadodara, 390010
EPABX: 91-265-2642942, 2642377, 2642557, 2642964, extn. No. 305
Fax: 91-265-2638382
erda@wilnetonline.net
www.erda.org

M.K. Shah
Sr. Manager (LV/SC GR II)
M.E. (Electrical), DBM, DMM
Electrical Research & Development Association
ERDA Road, G.I.D.C.
Makarpura, Vadodara, 390010
EPABX: 91-265-642942, 642377, 642557, 642964
erda@wilnetonline.net
www.erda.org

CERC — Consumer Education and Research Centre

Prof. Manubhai Shah
Chairman Emeritus
Consumer Education and Research Centre
Suraksha Sankool, Thaltej, Sarkhej-Grandhinager Highway
Ahmedabad 380 054
Gujarat, India
Tel: 91-79-7489945.46, 7450528, 7451097
Direct: 91-79-7489949
Fax: 91-79-7489947
cerc@wilnetonline.net
www.cercindia.org

Ashok Tandon, IPS (Retd.)
Managing Trustee
Consumer Education and Research Centre
Suraksha Sankool, Thaltej, Sarkhej-Grandhinager Highway
Ahmedabad 380 054
Gujarat, India
Tel: 91-79-7489945.46, 7450528, 7451097
Fax: 91-79-7489947
cerc@wilnetonline.net
www.cercindia.org

CPRI — Central Power Research Institute

K. Manohara, M.Sc
Joint Director
Central Power Research Institute
Government of India, Ministry of Power
Prof. Sir. C.V. Raman Road
Sadashivanagar Sub – PO.O.,
P.B. No. 8066m, Bangalore, 560 080, India
Tel: 91-80-3604572
Fax: 91-80-3601213
manohar@powersearch.cpri.res.in

Indian Institute of Technology

Dr. R.S. Agarwal
Professor of Mechanical Engineering
Department of Mechanical Engineering
Indian Institute of Technology
Hauz Khas, New Delhi-110 016, India
Tel: 91-11-26591120, 26526645
Fax: 91-11-26526645
rsarwal@mech.iitd.ernet.in

VOICE —Voluntary Organization in Interest of Consumer Education

H. Wadhwa
Manager Tech. & Admin.
Consumer Voice
Voluntary Organization in Interest of Consumer Education (VOICE)
Member, Consumers International
441(Basement)
Jangpura, Mathura Road
New Delhi-110014, India
Tel:91-11-24319078, 79, 80
Fax: 91-11-24319081
cvoice@vsnl.net
testing@consumer-voice.org
www.consumer-voice.org

Kamaljit Singh
Codex & Food Safety Officer
Consumer Voice
Voluntary Organization in Interest of Consumer Education (VOICE)
Member, Consumers International
441 (Basement)
Jangpusa New Delhi -14
Tel: 91-11-24319078-80

IIEC (working for BEE)

Tanmay Tathagat
Senior Energy Efficiency Specialist
Delhi Office
A-2 PRII Complex Sector-19, Dundahera
Old Delhi-Jaipur Highway Gurgaon-122001
Haryana, India
91-124-245.5395
Fax: 91-124-245.5395
ttathagat@iiec.org

BEE — Bureau of Energy Efficiency

Shashi Shekhar, I.A.S.
Joint Secretary
Director General
Bureau of Energy Efficiency
2nd Floor, NBCC Tower
15 Bhikaji Cama Place, New Delhi-66
Tel: 91-11-26178316 (Direct)
Fax: 91-11-26178328
shekhars_w000@yahoo.co.uk

BANGLADESH

Ministry of Energy and Mineral Resources

Engr. Md. Mohsin Ali
Joint Secretary
Power Division
Ministry of Energy and Mineral Resources
Bangladesh Secretariat
Dhaka-1000
Tel: 88-02-7168035
Fax: 88-02-8623316

S.M. Shamsul Alam
Secretary-in-Charge
Power Division
Ministry of Energy and Mineral Resources
Bangladesh Secretariat
Dhaka-1000
Tel: 88-02-7165918
Fax: 88-02-7173316

Engr. B.D. Rahmatullah
Director
Power Cell
Ministry of Energy & Mineral Resources
Govt. of the People's Republic of Bangladesh
BTMC Bhaban (8th level)
7-9 Kawran Bazar
Dhaka-1215, Bangladesh
Tel: 88-02-8122442, 9130914.8, ext. 36 (off)
Fax: 88-02-9121673, 8118941
dgpcmemr@citechoco.net

BSTI — Bangladesh Standards & Testing Institution

M. Liaquat Ali
Director (Physical)
ISO 9000 Lead Auditor
Bangladesh Standards & Testing Institution
Ministry of Industries
Maan Bhaban
116/KA, Tejgaon Industrial Area
Dhaka-1208
Bangladesh
Tel: 88-02-9897960
Fax: 88-02-9131581
bsti@bangla.net

BUET — Bangladesh University of Engineering & Technology

Mohammad Rezwan Khan, Ph.D.
Professor
Department of Electrical & Electronic Engineering
Bangladesh University of Engineering & Technology
Dhaka-1000, Bangladesh
Tel: 88-02-9665650-80, ext. 7105, 7473
Fax: 88-02-863026
rezwanm@eee.buet.ac.bd

Maglub Al Nur
Head of the Department
Bangladesh University of Engineering and Technology
Department of Mechanical Engineering
Dhaka-1000, Bangladesh
Tel: 88-02-9665636 (direct)
Fax: 88-02-8613046
headme@me.buet.ac.bd
maglub@me.buet.ac.bd

Professor Dr. Aminul Hoque
B.Sc.Engg., M.Sc.Engg., Ph.D., Post Doctor (U.K.)
Ex-Project Director/Vice-Chancellor (i.c.)
Mawlana Bhashani Science & Technology University
Santosh, Tangail-1902
Bangladesh
Tel: 88-0921-55400
Fax:88-0921-55399
vcmbstu@bdcom.com

NEPAL

Nepal Bureau of Standards & Metrology

Dr. Sita Ram Joshi
Deputy Director General
Nepal Bureau of Standards & Metrology
Balaju, Kathmandu, Nepal
Tel: 977-11-4356672
Fax: 977-11-4350689
srjoshi@nbsm.gov.np

Shree Krishna Maharjan
Incharge
Electrical Testing Laboratory
Nepal Bureau of Standards & Metrology
Balaju, Kathmandu
P.O. Box 985
Tel: 977-11-350445
Fax: 977-11-350689

Federation of Nepalese Chambers of Commerce & Industry

Hemant Dabadi, Ph.D.
Executive Director
Federation of Nepalese Chambers of Commerce & Industry
P.O. Box 269, Pachali
Shahid Shukra, FNCCI Milan Marg
Teku, Kathmandu, Nepal
Tel: 977-11-262061, 262218, 266889, 261601
Fax: 977-11-261022, 262007
hdabadi@fncci.org
http://www.fncci.org

SRI LANKA

NERD — National Engineering Research & Development

G.B. Wimalaratne
C.Eng., MIE(SL)
Electrical Engineer
Head, Dept. of Electrical & Electronics Eng.
National Engineering Research & Development
Centre of Sri Lanka (NERD)
Industrial Estate
Ekala, Ja-Ela
Sri Lanka
Tel:94-75-236284, 236384, 236307, 233151 (Direct)
Fax: 94-75-2354597

Ranjan Rodrigo
B.Sc., Metallugy (U.K.)
Chairman
National Engineering Research & Development
Centre of Sri Lanka (NERD)
Industrial Estate
Ekala, Ja-Ela
Sri Lanka
Tel: 94-11-236278

Fax: 94-11-236434
nerdc@sri.lanka.net

Sri Lanka Standards Institution (SLSI)

Jayampathie Dewasurendra
PG Dip.Mgt. MIEEE, I Eng (UK)
QWMS Lead Auditor IRCA (UK)
Assistant Director
(Electrical & Electronic Eng.)
Sri Lanka Standards Institution (SLSI)
No. 17, Victoria Place
Elvitigala Mawatha
Colombo 08, Sri Lanka
Tel: 94-11-671567-72
Fax: 94-11-469749
jdadee@slsi.slt.lk

DSD Liyanaarachchi
B.Sc., Dip Text, CTextFTI., MBA
Director
Sri Lanka Standards Institution (SLSI)
Laboratory Services Division
No. 17 Victoria Place
Elvitigala Mawatha
Colombo 08, Sri Lanka
Tel: 94-11-694985, 971567-72
Fax: 94-11-694985
Dl(a)slsi.slt.lk

M.C. Fernando
B.Sc (Special), FIP (SL)
Assistant Director
Electrical & Electronics
Sri Lanka Standards Institution (SLSI)
Laboratory Services Division
No. 17 Victoria Place
Elvitigala Mawatha
Colombo 08, Sri Lanka
Tel:94-11-687523, 697039 , 674618

Ceylon Electricity Board

Sisira Vitharana
BscEng, AMIE (SL)
Mechanical Engineer
Ceylon Electricity Board
Demand Side Management Branch
No. 340, R.A. De Mel Mawatha
Colombo 03, Sri Lanka
Tel: 94-11-575513, 575529
Fax: 94-11-575749
Eedsm4@ceb.lk

P. Kalubowila
BscEng (Hons.) Ceng, MIE(SL)
Chief Engineer (Air-Conditioning & Refrigeration)
Ceylon Electrcity Board
1st Floor, UPTO Building
95, Sir chittampalam A,
Gardiner Mawatha, Colombo 00200
Tel: 94-11-323110
Fax: 94-11-447931

Noel Priyantha
BscEng, C. Eng., MIE(SL)
Engineer (Load Research)
Ceylon Electricity Board
Demand Side Management Branch
No. 340, R.A. de Mel Mawatha
Colombo 00300, Sri Lanka
Tel: 94-11-575708, 575529
Fax: 94-11-575749
Eedsm2@ceb.lk
www.ceb.lk/dsm/dsm.html

Bandula S. Tilakasena
BSc Eng, Ceng, MIE(SL), MIEEE
Deputy General manager (Demand Side Management)
Ceylon Electricity Board
Demand Side Management Branch
No. 340, R.A. de Mel Mawatha
Colombo 00300, Sri Lanka
Tel: 94-11-575782, 575529
Fax: 94-11-575749
www.ceb.lk/dsm/dsm.html

Sunil Padmasiri
BA
Customer Education Assistant
Ceylon Electricity Board
Demand Side Management Branch
No. 340, R.A. de Mel Mawatha
Colombo 00300, Sri Lanka
Tel: 94-11-575513, 575529
Fax: 94-11-575749
Eedsm2@ceb.lk

University of Moratuwa

Rahula A. Attalage
Meng., DEA, Ph.D.
Senior Lecturer
University of Moratuwa
Department of Mechanical Engineering
Moratuwa, 10400, Sri Lanka
Tel: 94-11-650301
Fax: 94-11-647622
dinu@mech.mrt.ac.lk

CONSULTANTS AND SARI/Energy / NEXANT PERSONNEL

Consultant – INDIA

T.C. Kapoor
B.E. (Electrical)
F.I.E., M-ASQC. M-SEI
ASQC Certified Quality Auditor
Laboratory & Quality Consultant
10 Manak Vihar
Delhi-110092, India
Tel: 91-11-32152267
tckapoor@nda.usnl.net.in

Nexant SARI /Energy – BANGLADESH

A.S.M. Bashirul Huq
Senior Energy Specialist
SARI/Energy
House No. 13 (first floor)
Road No. 27, Block-JH
Banani, Dhaka-1213
Bangladesh

Tel: 88-02-8811373
Fax: 88-02-8812001
bhuq@sari-energy.org
bhuq@bol-online.com

Nexant SARI/Energy –NEPAL

Prakash Awasthi
Consultant
Nexant
(A Bechtel Affiliated Company)
G.P.O. Box-6507
Kathmandu, Nepal
Tel: 977-1-4477916
pawasthi@sari-energy.org
www.sari-energy.org

USAID – NEPAL

Mahesh P. Acharya
Country Coordinator
SARI/Energy
United States Agency for International Development
USAID/Nepal
Rabi Bhawan, Kalimati
G.P.O. Box 5653
Kathmandu, Nepal
Tel:977-1-270144, 272271
Fax: 977-1-272357
macharya@usaid.gov

Nexant SARI/Energy – SRI LANKA

K. Nareshkumar
Analyst
Nexant
(A Bechtel Affilited Company)
Room No. 541
The Lanka Oberoi
77, Steuart Place
Colombo-3
Tel:94-11-386.021
Fax: 94-11-386.021
knaresh@sari-energy.org
www.sari-energy.org

Appendix C International Laboratory Accreditation Co-operation

Source: http://www.ilac.org

What is ILAC?

What is laboratory accreditation?
Laboratory Accreditation provides a means of determining the competence of laboratories to perform specific types of testing, measurement and calibration

How does laboratory accreditation assist international trade and development?
A developing system of international mutual recognition agreements has enabled accredited laboratories to achieve a form of international recognition, thus allowing test data accompanying exported goods to be more readily accepted on overseas markets

What is ILAC's role?
ILAC is the world's principal forum for the development of laboratory accreditation practices, the promotion of laboratory accreditation, the assistance of developing accreditation systems, and the recognition of competent test facilities.

How is ILAC structured?
Seven Committees assist in progressing the work of ILAC: Accreditation Policy Committee; Technical Accreditation Issues Committee; Laboratory Committee; Public Affairs Committee; Arrangement Management Committee, Joint Development Support Committee and the Finance & Audit Committee

What is ILAC's role?
ILAC is an international cooperation between the various laboratory accreditation schemes operated throughout the world. Founded twenty years ago, ILAC first started as a conference in 1978 with the aim of developing international cooperation for facilitating trade by promotion of the acceptance of accredited test and calibration results. ILAC was formalized as cooperation in 1996 when 44 national bodies signed a Memorandum of Understanding (MOU) in Amsterdam. This MOU provided the basis for the further development of the Cooperation and the eventual establishment of a multilateral recognition agreement between ILAC member bodies.

On 2 November 2000, 36 laboratory accreditation bodies, full members of the International Laboratory Accreditation Cooperation (ILAC), from 28 economies worldwide signed an “arrangement” in Washington, DC to promote the acceptance of technical test and calibration data for exported goods.

As of August 2003, 44 laboratory accreditation bodies of ILAC have signed the multi-lateral, mutual recognition arrangement (the “ILAC Arrangement”) to promote the acceptance of accredited test and calibration data. This “ILAC Arrangement” provides significant technical underpinning to international trade. The key to the Arrangement is the developing global network of accredited testing and calibration laboratories that are assessed and recognized as being competent by ILAC Arrangement signatory accreditation bodies. The signatories have, in turn, been peer-reviewed and shown to meet ILAC’s criteria for competence. Now that the ILAC Arrangement is in place, governments can take advantage of it to further develop or enhance trade agreements.

The ultimate aim is increased use and acceptance by industry as well as government of the results from accredited laboratories, including results from laboratories in other countries. In this way, the free-trade goal of “a product tested once and accepted everywhere” can be realized.

As part of its global approach, ILAC also provides advice and assistance to countries that are in the process of developing their own laboratory accreditation systems. These developing systems are able to participate in ILAC as associate members, and access the resources of ILAC's more established members.

In conjunction with ILAC, specific regions have also established their own accreditation co-operations, notably in Europe (EA) and the Asia-Pacific (APLAC). These regional co-operations work in harmony with ILAC and are represented on ILAC's board of management. ILAC is encouraging the development of such regional co-operations in other parts of the globe.

Hence ILAC is the world's principal international forum for the development of laboratory accreditation practices and procedures, the promotion of laboratory accreditation as a trade facilitation tool, the assistance of developing accreditation systems, and the recognition of competent test facilities around the globe.

Frequently Asked Questions

Q. Can ILAC accredit my laboratory?
R. ILAC is an international cooperation of accreditation bodies rather than an accredit or of laboratories. ILAC’s full members (as well as its associates and affiliates) usually accredit laboratories in their own economy, but are often able to accredit facilities in other countries, when needed. If your country does not currently have an ILAC representative you will need to visit the on-line Directory on the ILAC website and locate an accreditation body in your region to contact directly.

Q. Will a product tested by an accredited laboratory in my country automatically be accepted in a foreign market?
R. This depends on several factors:

Firstly whether the goods are tested to a particular standard that is recognized or specified in the foreign market. Many countries have specific requirements for the testing of imported goods that must be met before the goods are accepted in their marketplace.

Secondly, is the laboratory accredited by a signatory to the ILAC Mutual Recognition Arrangement (often just referred to as the 'Arrangement')? Not all ILAC members are signatories to the Arrangement, and therefore their accredited facilities and test data may not be recognized in other countries.

Thirdly, even though a laboratory accredited by an ILAC Arrangement signatory is more likely to have its test data accepted in a foreign market, this is still no guarantee, as much work remains to be done in getting governments and regulators to understand the nature of both laboratory accreditation and the mechanism of mutual recognition via the Arrangement.

Q. Where can I get a list of accredited laboratories in a particular country?
R. The first place to look is on the ILAC website's on-line Directory. Many of ILAC's members have an on-line database of their accredited testing and calibration facilities and these can be found in the second column of the ILAC directory (the column headed Accredited Laboratory Directory). Simply click on the link in this column and you will be taken to the member's own directory. However please note that the contents and accuracy of the listings in these directories are the responsibility of the member concerned and ILAC takes no part in their updating or checking.

Q. How can I become a member of ILAC?
R. Many organizations are eligible to for ILAC membership either as a full member, associate, affiliate, stakeholder or as a national or regional body. For example, laboratories may participate in ILAC by joining one of the many laboratory associations that are stakeholder members in ILAC (these are listed in the on-line Directory). Laboratory accreditation bodies that are still in the process of establishing their own systems can join as an Affiliate. For a full explanation of these various membership options please visit the page entitled Membership of ILAC.

Q. What are the advantages of ILAC membership?
R. The benefits of ILAC membership include:

The opportunity to participate in the ILAC Mutual Recognition Arrangement, thus providing international recognition for your accredited facilities;
The opportunity to learn from, and interact with, experienced accreditation systems to assist with the development of your system;
Contact with other developing accreditation systems to discuss experiences and seek common solutions to problems. Once established, new systems are eligible for evaluation as a signatory the ILAC Arrangement;

A means to participate in the affairs of ILAC with regard to issues affecting laboratories, accreditation practices and laboratory-related standards.

The opportunity also to represent, and inform, your constituents on important matters in the international conformity assessment arena;

Participation in ILAC's annual general assembly;

Participation in ILAC's committees covering policy matters, technical issues, promotion and marketing, laboratory representation and development support for new accreditation systems;

Contact and information exchange with other professionals working in laboratory accreditation, as well other areas of conformity assessment and standardization;

Receipt of ILAC's regular newsletter, ILAC News;

Entry to the ILAC website members' area which provides access to the latest drafts of ILAC documents (for comment and voting), a range of ILAC resource material, and information from ILAC committees.

Being part of the international movement to raise awareness amongst industry, governments, regulators, trade officials and other users of testing and calibration services of the importance of accreditation and the use of accredited facilities.

For more information on the benefits of ILAC membership see Benefits of Being an ILAC Member or contact the ILAC secretariat on email: ilac@nata.asn.au

Q. Can I use information from ILAC publications and brochures in my own organization's documentation and presentations?
R. ILAC encourages the use of its brochures and publications by organizations wishing to use such material for areas related to education, standardization, accreditation, good laboratory practice or other purposes relevant to ILAC's area of expertise or endeavor.

ILAC's brochures on laboratory accreditation, etc may be reproduced, printed or distributed without need for formal permission from ILAC.

Organizations seeking permission to reproduce material from ILAC's guidance, procedural or information publications must contact the ILAC Chair or Secretariat in writing or via electronic means such as email. The request for permission should clearly detail:

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2) where the reproduced material will appear and what it will be used for;
3) whether the document containing the ILAC material will be distributed commercially, where it will be distributed or sold, and what quantities will be involved;
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How does laboratory accreditation assist international trade and development?

Many countries around the world have one or more organizations responsible for the accreditation of their nation's laboratories. Most of these accreditation bodies have now adopted an international guide, called ISO/IEC 17025, as the basis for the accreditation of their country's testing and calibration laboratories.

Adoption of this international guide has helped countries adopt a uniform approach to determining laboratory competence. This uniform approach allows countries with similar accreditation systems to establish agreements between themselves, based on mutual evaluation and acceptance of each other's accreditation systems.

Such international agreements, called mutual recognition agreements, are crucial in enabling test data to be accepted between these countries. In effect, each partner in such an agreement recognizes the other partner's accredited laboratories as if they themselves had undertaken the accreditation of the other partner's laboratories.

This developing system of international mutual recognition agreements between accreditation bodies has enabled accredited laboratories to achieve a form of international recognition, and allowed test data accompanying exported goods to be more readily accepted on overseas markets. This effectively reduces costs for both the manufacturer and the importers, as it reduces or eliminates the need for products to be retested in another country.

Countries without viable accreditation systems can also seek to have their laboratories accredited by established accreditation systems, so that their test data and associated goods can be accepted on foreign markets. These countries can also endeavor to develop their own accreditation system based on the structure and experience of these systems in other countries.

Membership of ILAC

On 20 January 2003, ILAC was successfully incorporated and became an Association under Dutch Law. In accordance with ILAC Decision GA 6.59, taken at the Berlin General Assembly in September 2002, the revised Articles of Association and the Bylaws were implemented as from this date. As a result, the categories of membership for ILAC have been revised and are detailed below.

FULL MEMBERS

Accreditation bodies that meet the requirements for Associates and have been accepted as signatories to the ILAC Mutual Recognition Arrangement;

ASSOCIATES

Accreditation bodies that:

i) operate accreditation schemes for testing laboratories, calibration laboratories, inspection bodies, and/or other services as decided from time to time by the ILAC General Assembly.

ii) can provide evidence that they are operational and committed to comply with:

   (a) the requirements set out in relevant standards established by appropriate international standards writing bodies such as the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) and ILAC application documents; and

   (b) the obligations of the ILAC Mutual Recognition Arrangement;

iii) are recognized in their economy as offering an accreditation service;

AFFILIATES

Accreditation bodies that are:

i) currently operating, being developed or intended to be developed for testing laboratories, calibration laboratories, inspection bodies, and/or other services as decided from time to time by the ILAC General Assembly

ii) declare their intention to operate their accreditation programs in compliance with the requirements set out in relevant standards established by appropriate international standards writing bodies such as the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) and ILAC application documents;

NATIONAL COORDINATION BODIES

Formally established national bodies having responsibility for the coordination of laboratory and/ or inspection body accreditation activity in particular economies. A National Coordination Body may, at the discretion of its constituent ILAC Full Members and Associates, represent them in the ILAC General Assembly and Committees. Full Members and Associates in an economy having a National Coordination Body may instead choose to represent themselves at meetings of the General Assembly. National mutual recognition arrangements under the auspices of a National Coordination Body do not entitle participating bodies to claim signatory status within the ILAC Mutual Recognition Arrangement nor participation in ILAC as a Full Member or an Associate.

REGIONAL COOPERATION BODIES

Formally established regional accreditation cooperation's having objectives similar to and compatible with ILAC, which are committed to the obligations of the ILAC Mutual

Recognition Arrangement and which consist of formally nominated representatives of the accreditation interests from at least four economies.

STAKEHOLDERS

Representative international, regional and national organizations having an interest in the work of ILAC and include bodies such as associations of laboratories, associations of laboratory practitioners, inspection body associations, purchasing organizations, regulatory authorities, consumer associations and trade organizations.

Please email the ILAC Secretariat for all enquiries on ILAC membership.

Appendix D Asia-Pacific Laboratory Accreditation Co-operation

Source: http://www.aplac.org

General Information

Asia Pacific Laboratory Accreditation Cooperation (APLAC) groups organizations in the Asia Pacific region responsible for accrediting testing and inspection facilities. Members are nationally recognized accreditation bodies and are usually owned or endorsed by government.

Accreditation is recognition by an authoritative body that an organization or individual is competent to carry out specific tasks. APLAC members assess laboratories and inspection bodies against international standards, and accredit them as competent to carry out specific tests or inspections. This gives assurance that the test or inspection results are valid. Assurance of accurate results contributes to protection of public health and safety, environmental protection and trade facilitation.

APLAC was initiated in 1992 as a forum to enable accreditation bodies to share information, harmonize procedures and develop Mutual Recognition Arrangements (MRAs) to enable accredited test and inspection results to be recognized across national borders.

The APLAC Memorandum of Understanding (MOU), establishing APLAC as a regional organization, was signed in April 1995 by representatives of accreditation bodies from the following economies: Australia, Brunei Darussalam, People's Republic of China, Hong Kong China China, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Papua New Guinea, Singapore, Chinese Taipei, Thailand, United States of America and Viet Nam. The nationally recognized accreditation bodies of Canada and the Philippines joined in 1996 and Nepal became a member in 1997 (it ceased its membership in 1999). In December 1999 Mexico became a member.

APLAC's principal objectives are to foster the development of competent laboratories and inspection bodies in member economies, to harmonize accreditation practices in the region and with other regions, and to facilitate mutual recognition of accredited test, measurement and inspection results. These objectives are consistent with and support the World Trade Organization’s Agreement on Technical Barriers to Trade (TBT Agreement). The TBT Agreement encourages WTO Members to recognize each other's conformity assessment results (testing, inspection and certification), provided they are confident the assessment procedures are equivalent.

APLAC is recognized by Asia Pacific Economic Cooperation (APEC) member economies as a Specialist Regional Body (SRB), assisting with the work of the APEC Sub-committee on Standards and Conformance (SCSC). The Chair of APLAC or a delegate attends APEC SCSC meetings. The list of APLAC Members almost mirrors that of APEC. The exceptions are Chile, Peru and Russia, which are members of APEC but have not yet applied for APLAC membership, and India, that is member of APLAC but is not an APEC member.

APLAC has active programs for information exchange between members, for the development of technical guidance documents, for inter-laboratory comparisons (proficiency testing), for training of laboratory assessors and for the development of procedures and rules for the establishment of Mutual Recognition Arrangements. APLAC also publishes a regular newsletter, APLAC News Notes.

APLAC Multilateral MRA

Ultimately, the purpose of all this activity and cooperation within APLAC is to harmonize regional accreditation practices and to extend the APLAC multilateral Mutual Recognition Arrangement (MRA), which was signed amongst seven APLAC members in Tokyo on 19 November 1997. A schedule of pre-evaluations and evaluations for accreditation bodies seeking to enter the APLAC MRA has proceeded since then. Now 18 of the 27 APLAC full members are signatories to the MRA. The signatories to the APLAC multilateral MRA are now:

NATA Australia
SCC Canada
CNAL People's Republic of China
HKAS Hong Kong, China
NABL India
KAN Indonesia
JAB Japan
IAJapan Japan
KOLAS Republic of Korea
IANZ New Zealand
SAC Singapore
CNLA Chinese Taipei
TLAS Thailand
A2LA United States of America
IAS United States of America
NVLAP United States of America
VILAS-STAMEQ Viet Nam

The contact details for current signatories may be found on the Parties to the APLAC MRA page.

APLAC is committed to further extending the APLAC multilateral MRA. At APLAC 2000, SCC of Canada joined the APLAC MRA, thereby achieving one of the targets set by APEC, to have all developed economies as members of the APLAC MRA. Consultancy assistance has been provided by APLAC members to assist others to prepare for formal evaluation by APLAC MRA evaluation teams. The continuing challenge for APLAC is to foster the development of other accreditation bodies in the region. APLAC has joined the global ILAC Arrangement (inaugural signing, November 2000) as a Recognized Regional Body, and the signatories to the APLAC MRA are signatories to the ILAC MRA. To foster the development of the global ILAC MRA, liaison is maintained with such regional bodies as the European co-operation for Accreditation (EA), the National Cooperation for Laboratory Accreditation (NACLA), the Interamerican Accreditation Cooperation (IAAC) and the Southern African Development Community Cooperation on Accreditation (SADCA).

Under the mutual recognition agreements between laboratory accreditation organizations, each organization recognizes the equivalence of accreditations performed by its overseas counterparts, and promotes the equivalence of such accreditations within its own economy. This reduces the need for re-testing of products in an importing economy and saves time and money for exporters. Before entering into such agreements, laboratory accreditation bodies have responsibilities to thoroughly evaluate each other's systems. These agreements also include mechanisms to ensure that test results covered by the agreement carry the same degree of accuracy and credibility on an ongoing basis.

APLAC Membership

Full Members
Australia National Association of Testing Authorities, Australia (NATA) 2,3,4

Brunei Darussalam Ministry of Development (Construction Planning and Research Unit)

Canada Standards Council of Canada (SCC) 2,3,4

People's Republic of China National Accreditation Board for Laboratories (CNAL) 2,3,4

Hong Kong, China Hong Kong Accreditation Scheme (HKAS) 2,3,4

India National Accreditation Board for Testing & Calibration Laboratories (NABL) 2,3,4

Indonesia Komite Akreditasi Nasional - The Accreditation Body of Indonesia (KAN) 2,3,5

Japan International Accreditation Japan (IAJapan) 2,3,4

Japan Accreditation Board for Conformity Assessment (JAB)2,3,5

Japan Chemical Laboratory Accreditation (JCLA)

Voluntary EMC Laboratory Accreditation Center (VLAC)

Republic of Korea Korea Laboratory Accreditation Scheme (KOLAS)2,3,4

Malaysia Department of Standards Malaysia (DSM) 2

Mexico Entidad Mexicanade Accreditación, a.c. (EMA) 2

New Zealand International Accreditation New Zealand (IANZ) 2,3,4

Papua New Guinea Papua New Guinea Laboratory Accreditation Scheme (PNGLAS)

Philippines Bureau of Product Standards Laboratory Accreditation Scheme (BPSLAS)2
Singapore Singapore Accreditation Council – Singapore Laboratory Accreditation

Scheme (SAC-SINGLAS) 2,3,4

Chinese Taipei Chinese National Laboratory Accreditation (CNLA)2,3,4

Thailand Department of Medical Sciences, Ministry of Public health (DMSc) 5

Thai Industrial Standards Institute(TISI) 2,3,4

United States of America American Association for Laboratory Accreditation (A2LA)2,3,4<

International Accreditation Service, Inc. (IAS)2,3,5

National Voluntary Laboratory Accreditation Program (NVLAP)2,3,4

Perry Johnson Laboratories

National Quality Assurance Laboratory Services (NQA)

Vietnam Directorate for Standards and Quality (STAMEQ) 2,3,4

Associate Members

Republic of Korea Korea Testing and Research Institute for Chemical Industry (KOTRIC)

Chinese Taipei National Institute of Environmental Analysis (NIEA)

Chinese Taipei Council of Labor Affairs

- ILAC Regional Cooperation Body Member
- ILAC Full Member

- Global Arrangment Signatory
- APLAC Multilateral MRA - Testing and Calibration
- APLAC Multilateral MRA - Testing Only
- APLAC Multilateral MRA - Calibration only

Structure of APLAC

APLAC General Assembly

The General Assembly is the primary body of APLAC. All Full Members and Associate Members are entitled to send delegates to General Assembly meetings. Each Full Member body economy of APLAC has one vote on issues decided in the General Assembly. Each economy has only one vote regardless of the number of full APLAC members per economy.

Previous meetings/General Assemblies:
Inaugural APLAC meeting Hong Kong, China April, 1992
Second APLAC meeting Ottawa, Canada October, 1992
Third APLAC meeting The Hague, Netherlands June, 1993
Fourth APLAC meeting Singapore November, 1993
Fifth APLAC meeting Gaithersburg, USA March, 1994
Sixth APLAC meeting Hong Kong, China October, 1994
Seventh APLAC meeting Jakarta, Indonesia April, 1995

First APLAC General Assembly Singapore February 1996
Second APLAC General Assembly Sydney, Australia November, 1996
Third APLAC General Assembly Tokyo, Japan November, 1997
Fourth APLAC General Assembly Auckland, New Zealand, October 1998
Fifth APLAC General Assembly New Delhi, India , November / December1999
Sixth APLAC General Assembly Pasadena, A, USA, October 2000
Seventh APLAC General Assembly Beijing, China October 2001
Eigth APLAC General Assembly, Vancouver, Canada, November 2002
The Ninth APLAC General Assembly will be held in Seoul, Korea, in the week of 9-14 November, 2003. KOLAS will be the host.

Details concerning the logistical arrangements for the 2003 meeting will be supplied to APLAC members as they become available

Signatories of the APLAC MRA

NATA Australia
SCC Canada
CNAL People's Republic of China
HKAS Hong Kong, China
NABL India
KAN Indonesia
JAB Japan
IAJAPAN Japan
KOLAS Republic of Korea
DSM Malaysia
IANZ New Zealand
SAC Singapore
CNLA Chinese Taipei
DMSc Thailand
TLAS Thailand
A2LA United States of America
IAS United States of America
NVLAP United States of America
VILAS-STAMEQ Viet Nam

AUSTRALIA

NATA
Australia
Mr Anthony J Russell
Chief Executive
NATA
7 Leeds Street
Rhodes NSW 2138
AUSTRALIA
Tel: +61 2 9736 8222
Fax: +61 2 9743 5311
E-mail: trussell@nata.asn.au
Internet: http://www.nata.asn.au/

CANADA

SCC
Canada
Ms Joanne Dupont
Senior Program Officer
Standards Council of Canada
Suite 200, 270 Albert Street
Ottawa, Ontario K1P 6N7
CANADA

Phone: +1-613-238 3222 (Ext. 442)
Fax: +1-613-569 7808
E-mail: jdupont@scc.ca
Internet: http://www.scc.ca/

PEOPLE'S REPUBLIC OF CHINA

CNAL
China
Mr LIU Anping
Executive Director
China National Accreditation Board for Laboratories (CNAL)
9# Madian East Road
Tower B
Haidian District
Beijing 100080
PEOPLE'S REPUBLIC OF CHINA
Tel: +86 10 8226 0759
Fax: +86 10 8226 0759
E-mail: liuap@cnca.gov.cn
Internet: http://www.cnal.org.cn/

HONG KONG, CHINA

HKAS
Hong Kong ,China
Mr Terence S S Chan
Senior Accreditation Officer, HKAS
36th Floor, Immigration Tower
7 Gloucester Road
Wan Chai
HONG KONG, CHINA
Tel: +852 2829 4838
Fax: +852 2824 1302
E-mail: sschan@itc.gov.hk
Internet: http://www.info.gov.hk/itc/hkas

INDIA

NABL
India
Dr A K CHAKRABARTY
Adviser, DST and Director,
NABL
Under Department of Science & Technology
Apartment No B/4
Qutab Hotel
New Mehrauli Road
New Delhi 110 016

INDIA
Tel: +91 11 652 9718/652 6890
Fax: +91 11 652 9716/652 6890
E-mail: akc@nabl-india.org

INDONESIA

KAN
Dr SUNARYA
Deputy Director General BSN/Executive
Director of KAN
Komite Akreditasi Nasional – KAN
Manggala Wanabakti Blok IV, 4th floor
Jl. Gatot Subroto
Jakarta 10270
INDONESIA
Tel: +62 21 574 7042/3
Fax: +62 21 574 7045
E-mail: laboratorium@bsn.or.id
Internet: http://www.bsn.or.id/

JAPAN

JAB
Japan
Mr Yuichiro Isu
Executive Director
The Japan Accreditation Board for Conformity Assessment (JAB)
Osaki West Building, 1st Floor
Osaki 2-8-8, Shinagawa-ku
Tokyo 141-0032
JAPAN
Tel: +81 3 5487 0240
Fax: +81 3 5487 2050
E-mail: yisu@jab.or.jp
Internet: http://www.jab.or.jp/

IAJAPAN

Mr Juichi NAGANO
Chief Executive
International Accreditation Japan (IAJapan)
National Institute of Technology & Evaluation
Nishihara 2-49-10, Shibuya-ku
Tokyo 151-0066
JAPAN
Tel: +81 3 3481 1938
Fax: +81 3 3481 1937
E-mail: iajapan@nite.go.jp

Internet: http://www.nite.go.jp/asse/iajapan

REPUBLIC OF KOREA
KOLAS
Korea
Mr Dong-Yong KIM
Director, Laboratory Accreditation Division
Korea Laboratory Accreditation Scheme
(KOLAS)
2 Joongang-dong,
Kwacheon-shi, Kyunggi-do, 427-010
REPUBLIC OF KOREA
Tel: +82 2 507 7649
Fax: +82 2 507 6875
E-mail: kolas@ats.go.kr
Internet: http://kolas.ats.go.kr/

MALAYSIA
DSM
Ms KHALIDAH Mustafa
Director of Accreditation
Department of Standards Malaysia (DSM)
Ministry of Science, Technology and the Environment of Malaysia
Level 1 & 2, Block C4, Parcel C
Federal Government Administrative Centre
62502 Putrajaya
MALAYSIA
Tel: +603 8885 8000
Fax: +603 8888 5060
E-mail: khalidah@dsm.gov.my
Internet: http://www.dsm.gov.my/

NEW ZEALAND
IANZ
New Zealand
Dr Llewellyn RICHARDS
Chief Executive
International Accreditation New Zealand (IANZ)
Level 1, 626 Great South Road, Greenlane
(Private Bag 28908, Remuera)
Auckland 1136
NEW ZEALAND
Tel: +64 9 525 6655
Fax: +64 9 525 2266
E-mail: staff@ianz.govt.nz
Internet: http://www.ianz.govt.nz/

SINGAPORE
SAC-SINGLAS
Singapore
Ms CHANG Kwei Fern
Programme Director (Laboratory/Inspection)
Singapore Accreditation Council
SPRING Singapore
2 Bukit Merah Central
SINGAPORE 159835
Tel: +65 6279 1847
Fax: +65 6272 1937
E-mail: mailto:kfchang@spring.govt.sg
Internet: http://www.sac-accreditation.org.sg/

CHINESE TAIPEI
CNLA
Chinese Taipei
Mr Nigel JOU
Director, CNLA Secretariat
30, Ta-Hsueh Road
Hsinchu, Taiwan 300
CHINESE TAIPEI
Tel: +886 3 572 3316
Fax: +886 3 572 6308
E-mail: nigel_jou@itri.org.tw
Internet: http://www.cnla.org.tw/

THAILAND
TLAS
Mr Surachai THALEONGCHOK
Secretary-General
Thai Industrial Standards Institute
Rama VI Road, Ratchathewi District
Bangkok 10400
THAILAND
Tel: +66 2 202 3400, 245 7802
Fax: +66 2 246 4085
E-mail: mailto:bureau4@tisi.go.th
Internet: http://www.tisi.go.th/

Dr Panadda SILVA
Director, Bureau of Laboratory Quality
Standards
Department of Medical Sciences
Ministry of Public Health
Tiwanon Road

Nondhaburi 11000
THAILAND
Tel: +66 2 951 1278
Fax: +66 2 951 1270
E-mail: mailto:Chongdee@dmsc.moph.go.th
Internet: http://www.dmsc.moph.go.th/

UNITED STATES OF AMERICA

A2LA
Mr Peter S Unger
President
American Association for Laboratory
Accreditaton (A2LA)
5301 Buckeystown Pike, Suite 350
Frederick, MD 21704-8307
UNITED STATES OF AMERICA
Tel: +1 301 644 3212
Fax: +1 301 662 2974
Email: punger@a2la.org
Internet: http://www.a2la.org/

IAS
Mr C. P. RAMANI
President
International Accreditation Service Inc
5360 Workman Mill Road
Whittier, CA 90601
UNITED STATES OF AMERICA
Tel: +1 562 699 0543, ext. 3254
Fax: +1 562 692 2845
E-mail: info@iasonline.org
Internet: http://www.icboes.org/

NVLAP
Mr David Faison
Acting Chief, Laboratory Accreditation Program
NIST/NVLAP
820 West Diamond Avenue, Room 287
(100 Bureau Drive, Stop 2140)
Gaithersburg, MD 20899-2140
(Gaithersburg, MD 20899-2140)
UNITED STATES OF AMERICA
Tel: +1 301 975 4027
Fax: +1 301 926 2884
Email: faisond@nist.gov
Interent: http://www.nist.gov/nvlap

VIETNAM

VILAS
Dr Ho Tat Thang
Deputy Director General-
VILAS-STAMEQ
70 Tran Hung Dao St
Hanoi
VIETNAM
Tel: +84 4 822 1883
Fax: +84 4 9 422 110
Email: vpcongnhan@fpt.vn

Figure 1: BIS (Sahibabad)

Figure 2: BIS – Water Heater Testing

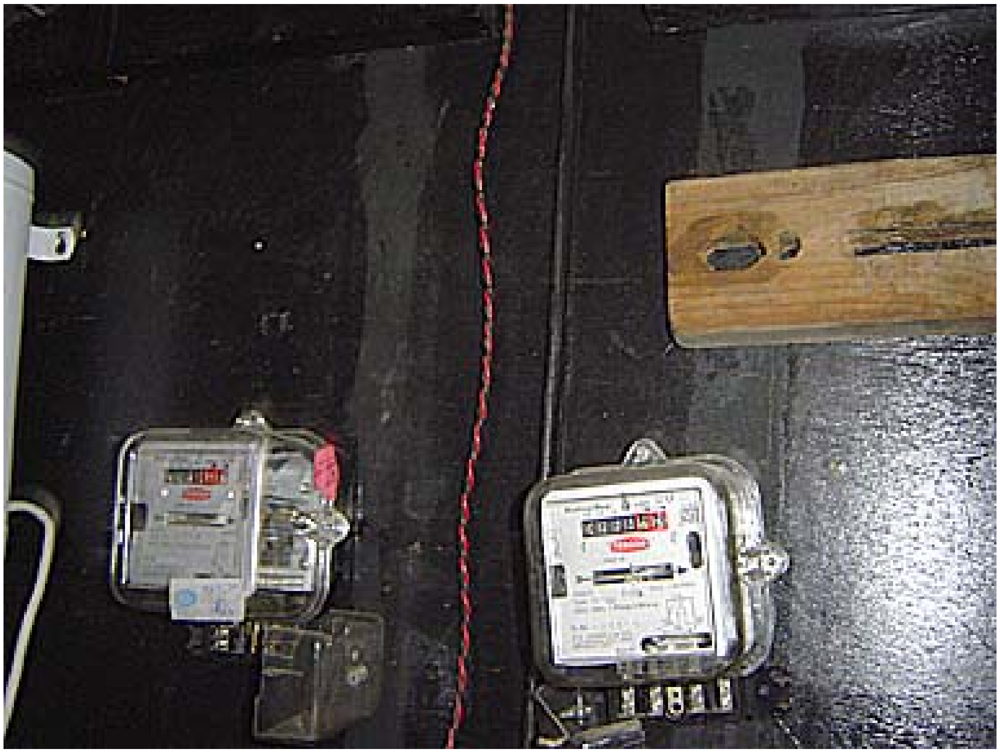

Figure 3: BIS Energy Meters Used in Water Heater Testing

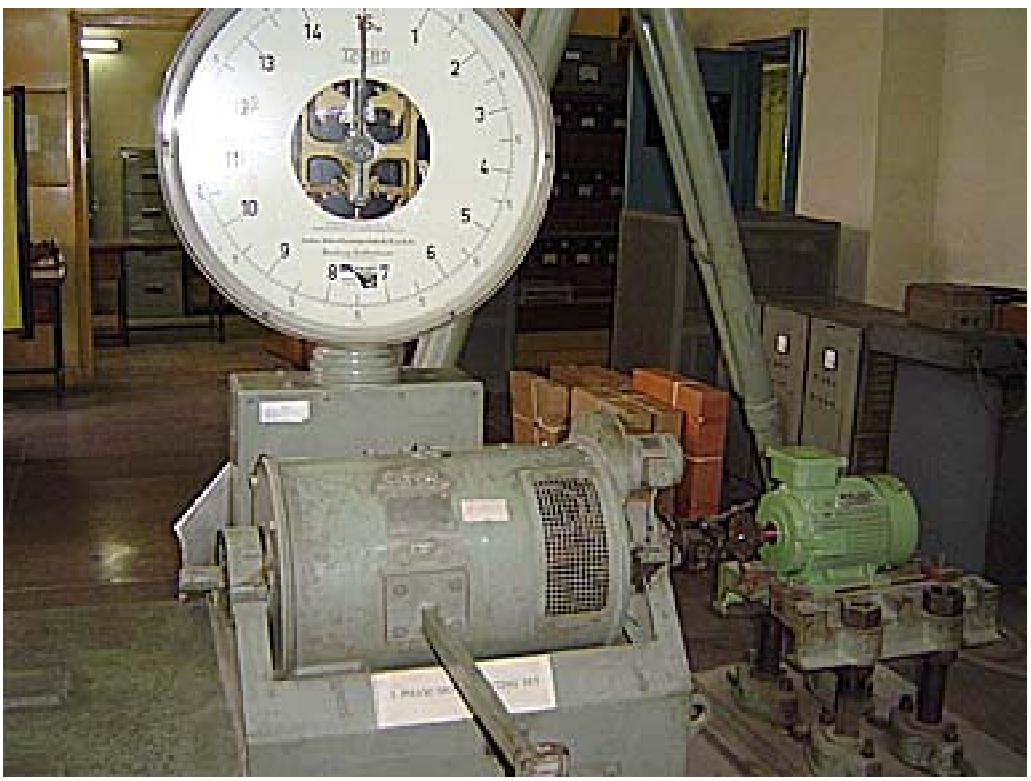

Figure 4: BIS – Motor Testing (old German Equipment)

Figure 5: BIS – Exhaust Fan Test Apparatus – Anemometer in Forground

Figure 6: BIS – Ceiling Fan Test Setup

Figure 7: BIS – Ceiling Fan Test Setup

Figure 8: ERTL (N) - High End Calibration Equipment

Figure 9: ERTL (N)

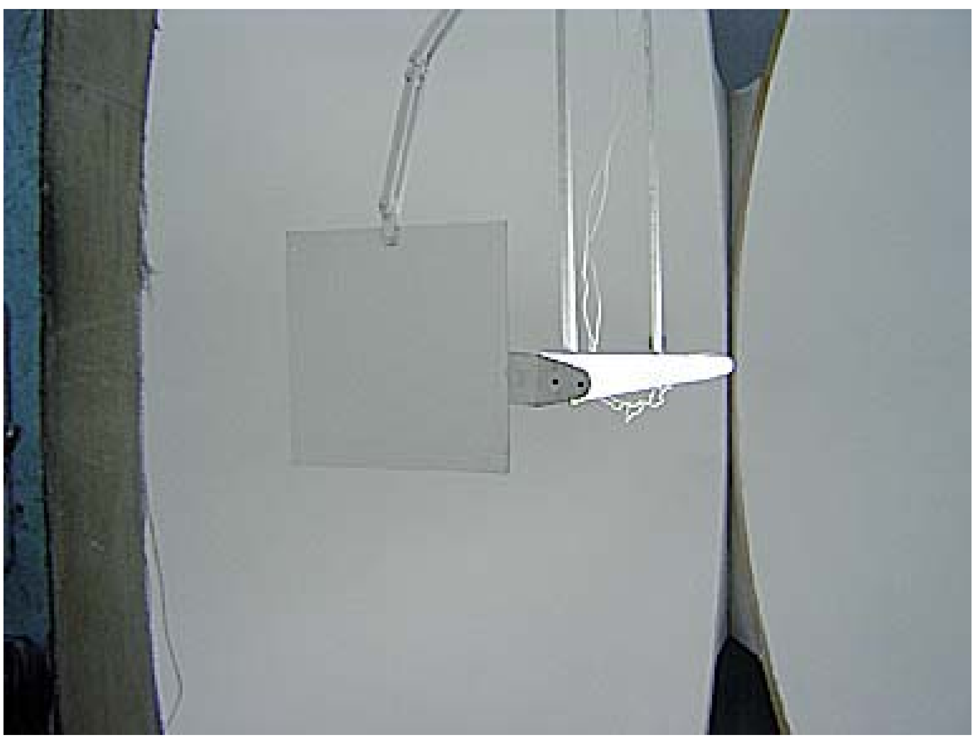

Figure 10: ERDA - Photometric Integrating Sphere

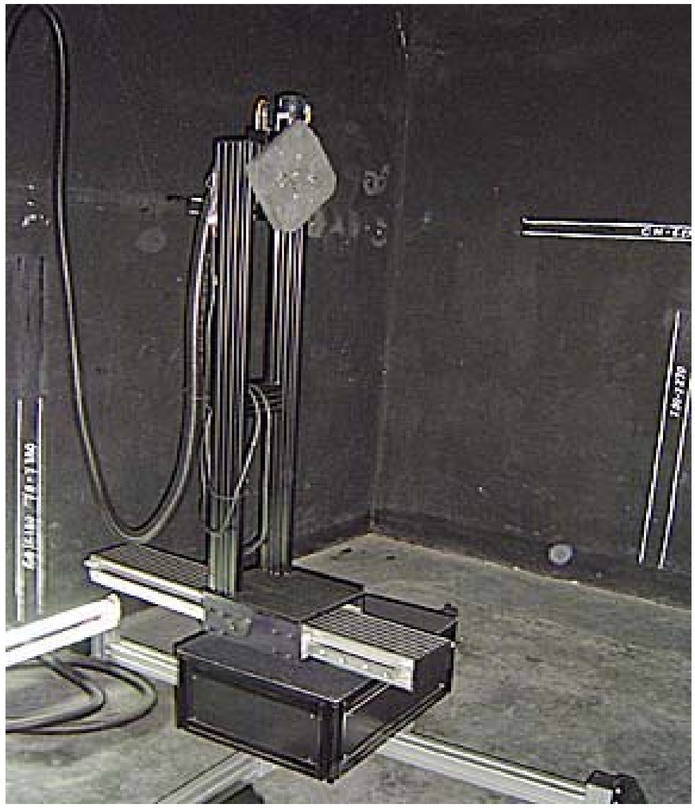

Figure 11: ERDA - Goniometer

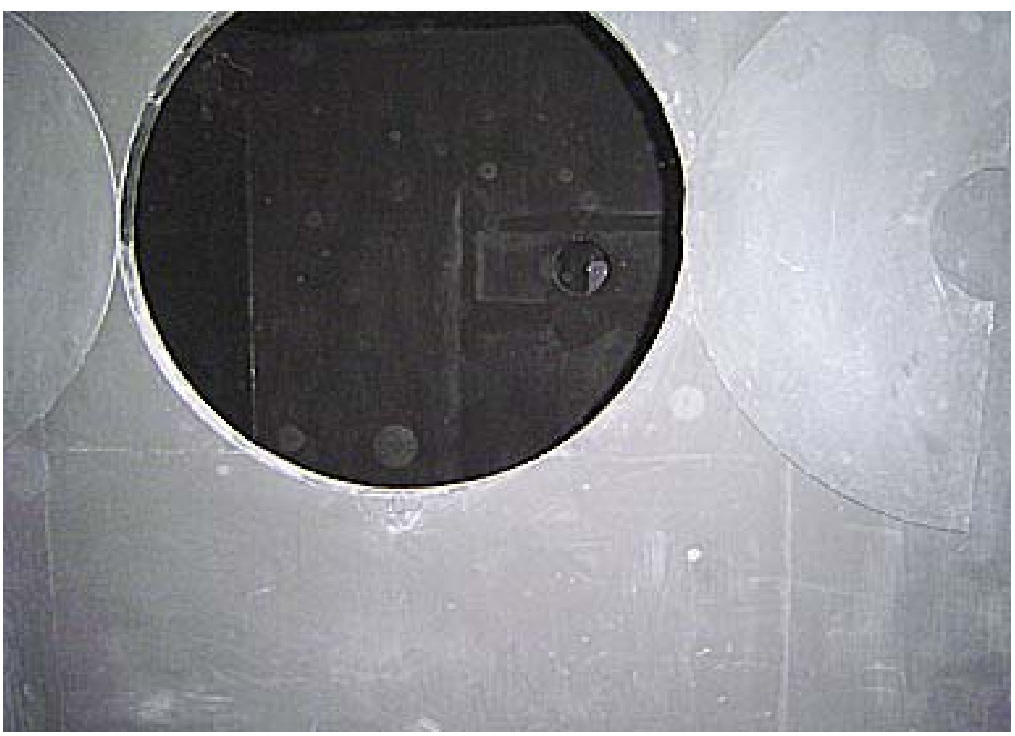

Figure 12: Part of Goniometer Setup - photometer

Figure 13: ERDA - Motor Testing Facility

Figure 14: ERDA - Data Acquisition

Figure 15: ERDA - Instrumentation Panel

Figure 16: CERC - Integrating Sphere

Figure 17: CERC - Photometer and Sphere

Figure 18: CERC - Display Comparing Ceiling Fan Regulators

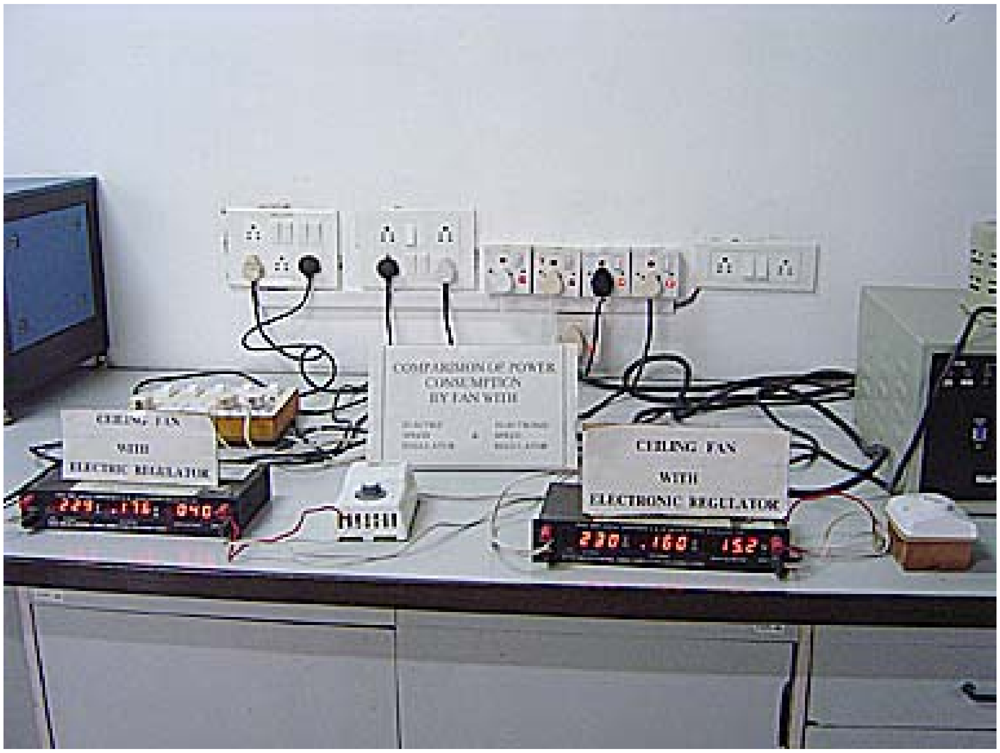

Figure 19: CERC - Regulators for Ceiling Fans

Figure 20: CERC - Exhaust Fan Chamber

Figure 21: CERC

Figure 22: CERC

Figure 23: CERC - Exhaust Fan Air Delivery Setup

Figure 24: CERC - Ceiling Fan Test

Figure 25: CERC - Ceiling Fan Test

Figure 26: CERC - Pedestal Fan Test Room

Figure 27: CERC - Refrigerator Room Conditioner (in test chamber)

Figure 28: CERC - Refrigerator Test Stand

Figure 29: CERC - Air Flow Measurement for Air Conditioner

Figure 30: CERC - Room Conditioning Equipment for Indoor Side of AC Test Room

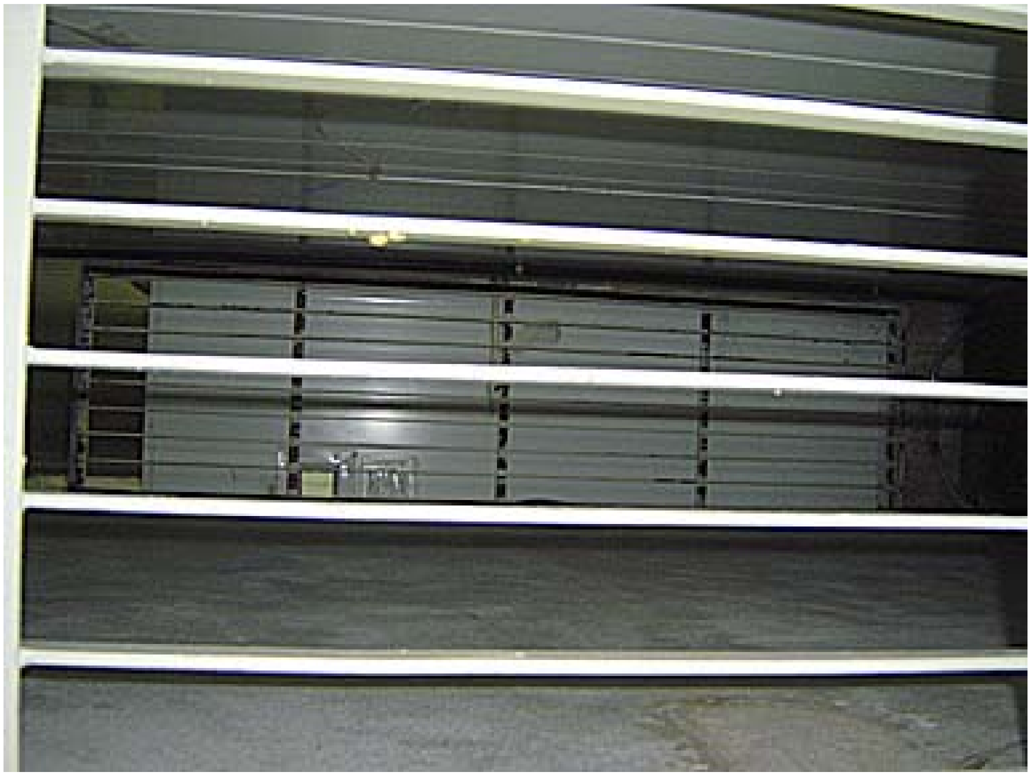

Figure 31: CERC - Annulus Surrounding AC Test Room (rotate photo)

Figure 32: CERC - Outdoor Side of AC Test Room

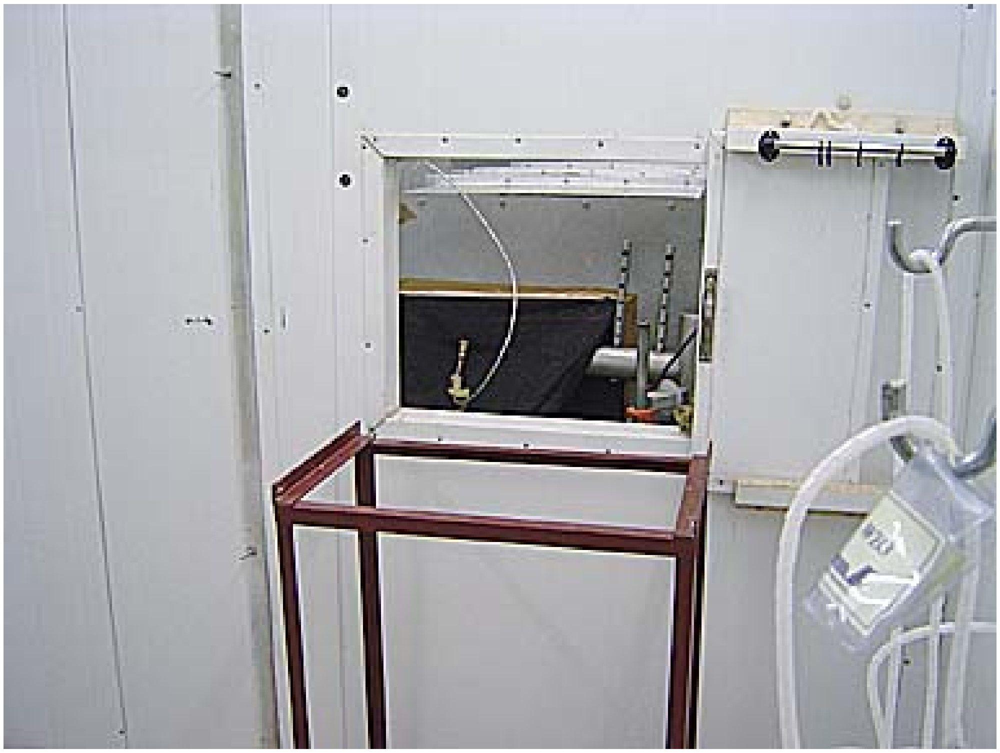

Figure 33: CERC - Outdoor Side of AC Test Room

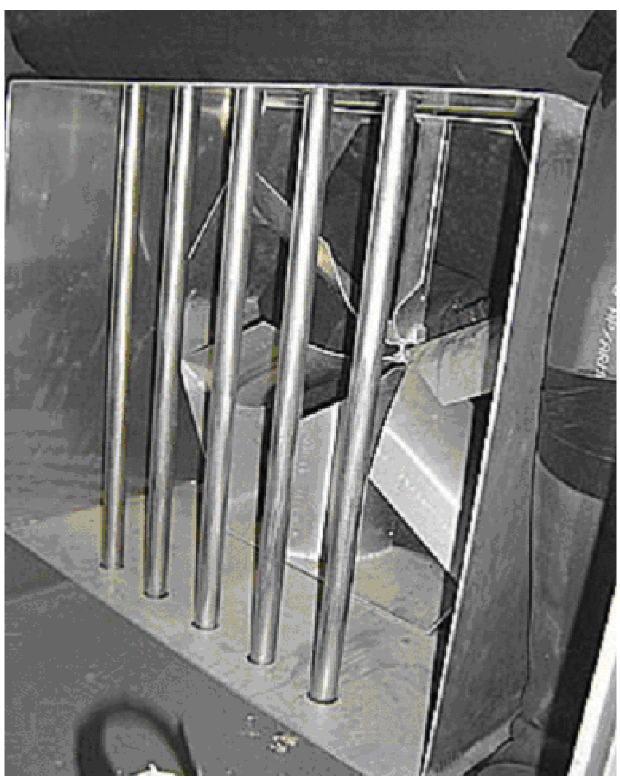

Figure 34: CERC - Air Mixing Apparatus - Part of Psychrometric Airflow Apparatus

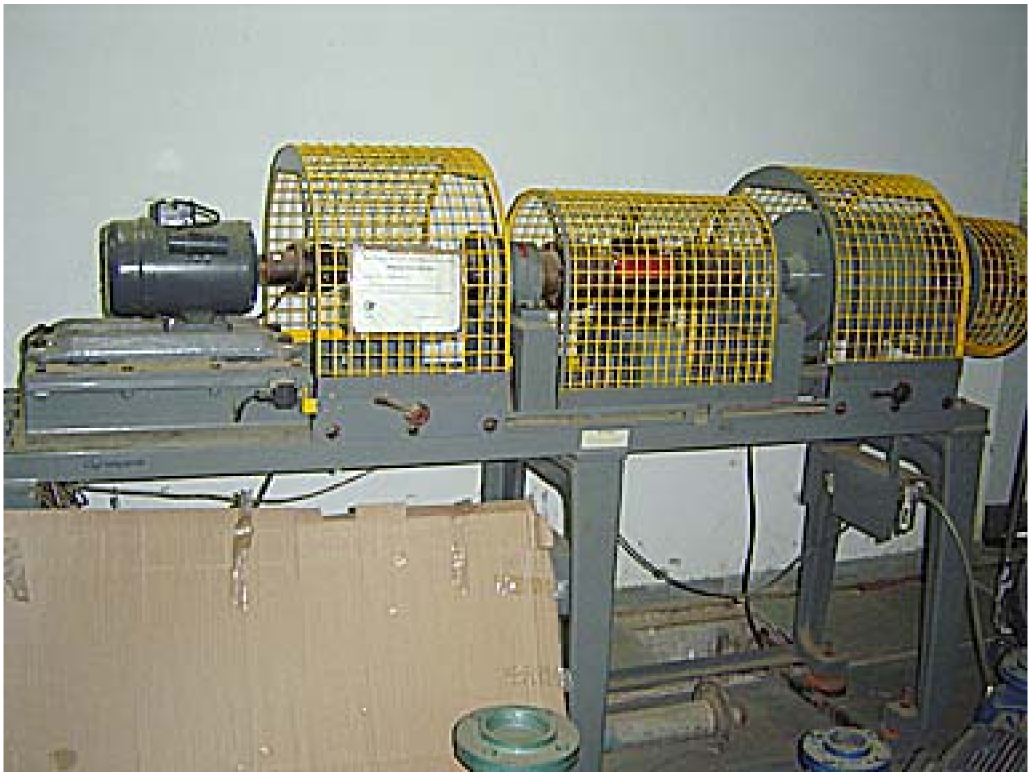

Figure 35: CERC - Motor Testing Apparatus

Figure 36: CERC- Motor / Pump Testing Apparatus

Figure 37: BSTI - Electricity Meter Testing

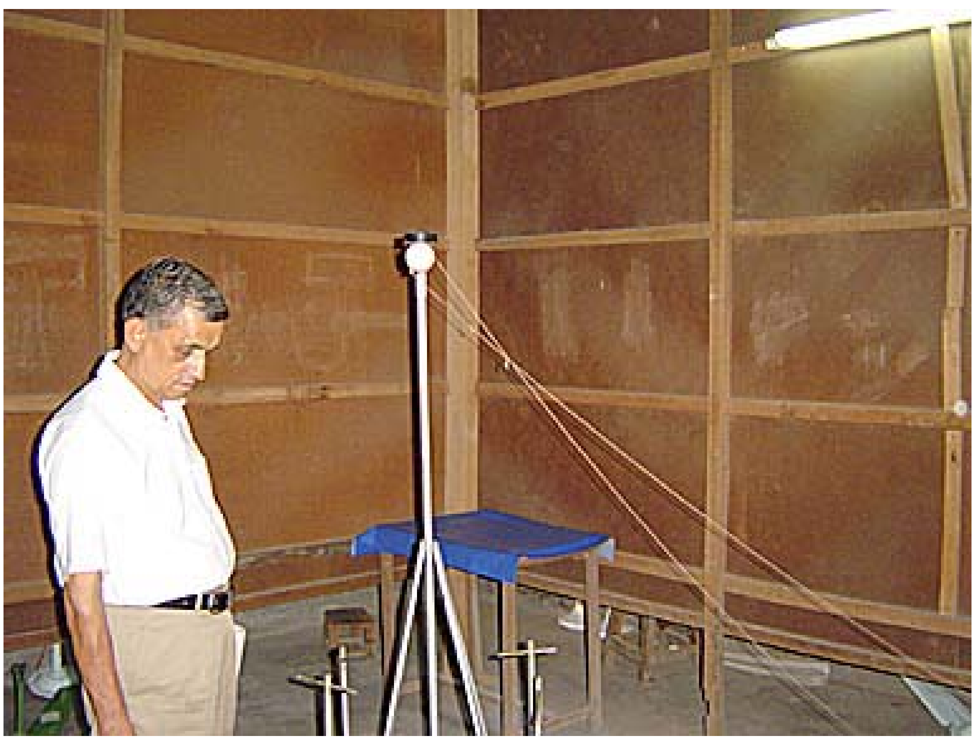

Figure 38: BSTI - Ceiling Fan Test Chamber

Figure 39: BSTI - Ceiling Fan Test

Figure 40: BSTI - Integrating Sphere (used for incandescent, GSL, light bulbs)

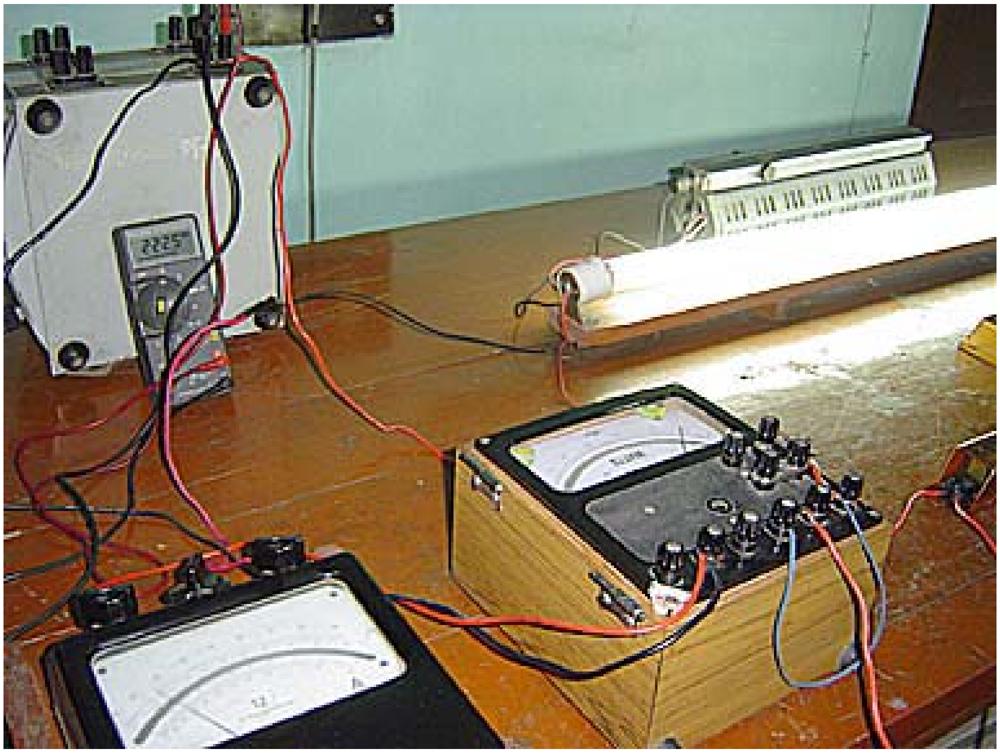

Figure 41: BSTI - Voltmeter, Ammeter, Wattmeter for lighting tests

Figure 42: NBS&M - Integrating Sphere – not operational

Figure 43: NBS&M - Test Facility (Performance)

Figure 44: Fluke Calibrator - needs repair

Figure 45: NERD - Integrating Sphere

Figure 46: NERD - Data Recording Equipment - lighting lab

Figure 47: NERD

Figure 48: NERD

Figure 49: SLSI

Figure 5048: SLSI Instrumentation

Figure 5149: SLSI - Small Integrating Sphere

Figure 50: CEB Poster for CFL Scheme

Figure 51: CPRI - Bangalore

Figure 52: CPRI -conditioning equipment for environmental chamber

Figure 55: Control Panel for Environmental Chamber (walk in type)

Figure 56: CPRI - Environmental Chamber control panel

Figure 57: CPRI - Environmental Chamber -will be used for testing refrigerators

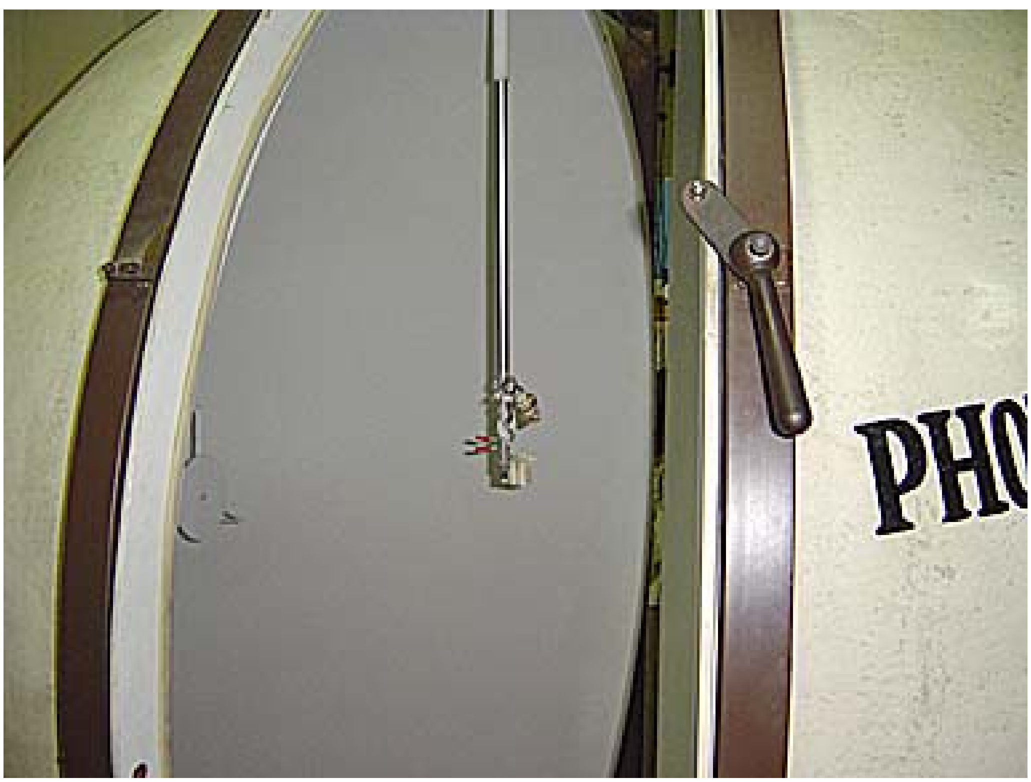

Figure 58: CPRI - Integrating Sphere

Figure 59: Integrating Chamber for fluorescent tube lights

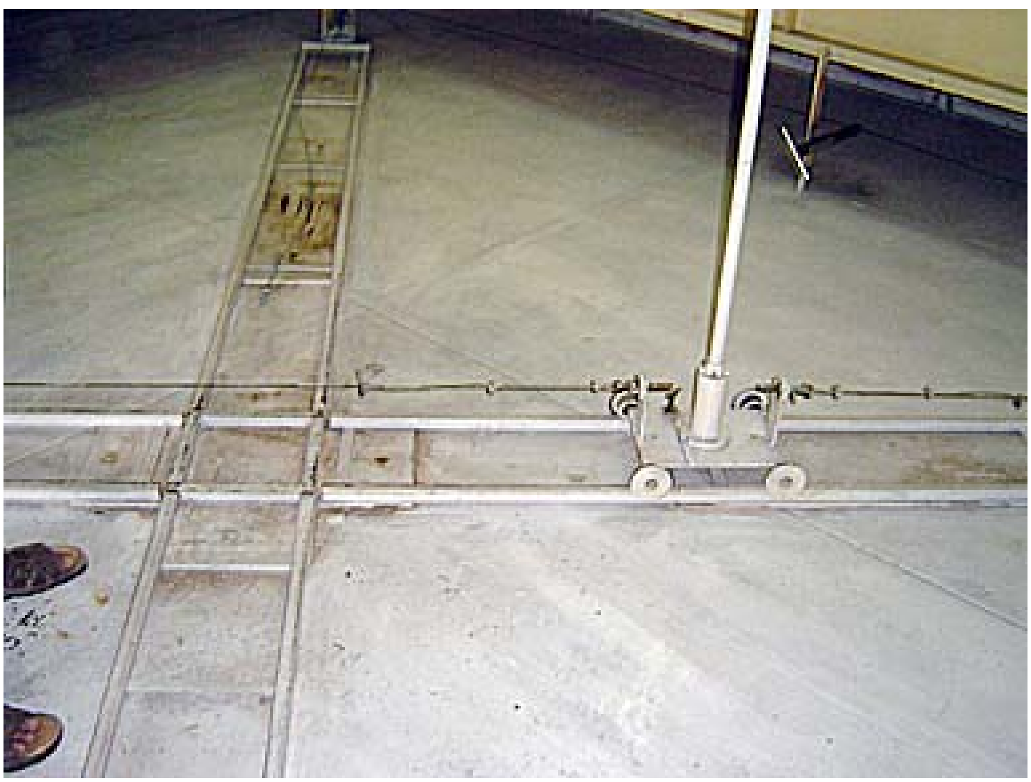

Figure 60: CPRI - Ceiling fan set up for moving anemometer

Figure 61: CPRI - Ceiling Fan Setup - pulley for positioning anemometer

Figure 62: ITT Delhi - Agarwal's refrigerator room

Figure 63: Detail of RTD fed into freezer compartment

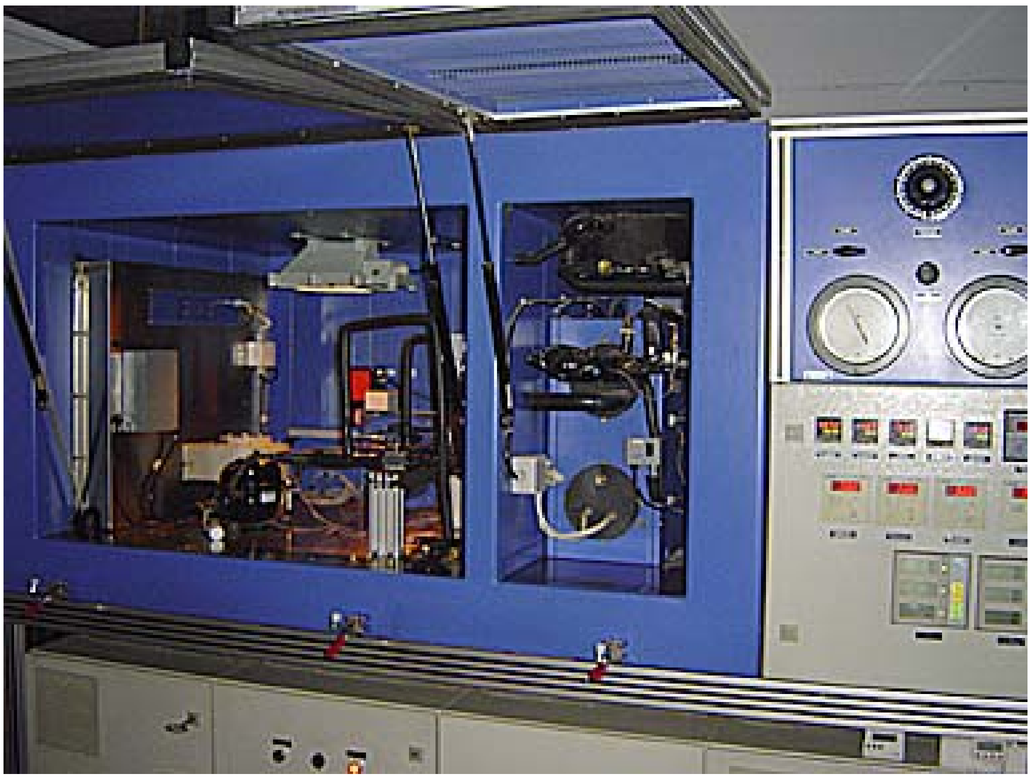

Figure 64: ITT Delhi - Equipment for Determining AC Compressor Performance & Efficiency